Farm Chemicals

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In this issue . . .

Because of the importance of farm chemicals in combatting pests and helping farmers raise more food and fiber to feed an ever-increasing population, knowledge of when and where bugs will strike is of prime importance to formulators and mixers who will supply the chemicals to keep plants pest-free. That's the reason for our exclusive pest survey by Washington Correspondent John Harms, on page 13. The map on page 15 shows probable areas of infestation.

Mixed fertilizers marketed in the United States during the 1949–1950 fertilizer season were studied extensively by K. G. Clark and W. M. Hoffman, of the Bureau of Plant Industry, USDA. Their research was aimed at determining information on chemical composition of the materials. In Part One of their report, the scientists give information on various forms of phosphorus in fertilizers. The report appears on page 17.

Although the pesticide industry has expanded by leaps and bounds during the past decade, it has been hard pressed to match the population increase in the United States and the resultant need of pest control chemicals to help make more food available to everyone. This problem was one of several discussed by members of the National Agricultural Chemical Association at their spring meeting in San Francisco April 6–9. For a resume of the convention talks, read the article on page 24.

Back in 1914 agricultural leaders suggested that something more than just nitrogen, phosphorus and potash was needed to insure big, healthy plants. That's when boron was recommended as a plant nutrient to supplement NPK. Since that time, many more minor elements have been found to be beneficial to crops. For an exhaustive summary of minor elements, read Frank A. Gilbert's article on page 27.

E. F. Dietz, the man who wrote the provocative letter on page 33, is a Wisconsin farmer. A graduate of Wisconsin College of Agriculture in 1917, he spent some time in county agent work and says he always has taken an interest in "the soils angle of successful farming."

Ever wonder how much material you really have stored in that bin? If your present indicator doesn't always tell you accurately, you may be interested in the Bin-Dicator described on the last page of this issue.

farm chemicals

Formerly
American Fertilizer & Allied Chemicals

Established 1894

PIONEER JOURNAL OF THE FARM CHEMICALS INDUSTRY

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Contents

Cover Story

Nitramoncal, a compound fertilizer of ammonium nitrate and calcium carbonate, is the main product of the Oesterreichische Stickstoffwerke Inc., Vienna, Austria. Photo shows the force water filter tank of the plant, one of the most modern in Europe for extraction of nitrogen from the air.

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farm chemicals facts

. . . *Briefly Noted*

Harvey P. Hood and **John M. Kingsley** have been elected to the board of directors of **International Paper** company to fill vacancies. Hood is president of H. P. Hood & Sons of Boston, largest dairy company in New England. Kingsley has served as financial officer of Henry Phipps Estates for the past 10 years and is a director of the Bessemer Trust company.

New Buffalo sales and engineering office of **Multiwall** division, St. Regis Paper company is being headed by **Kenneth L. Moore** as manager. Moore has been handling sales in the northern New York area for the past two years and has been with the company since 1937. The Buffalo office opened April 1.

Ethyl corporation, New York, has promoted **Dr. Charles L. Smith** to the newly-created position of associate director of product development in charge of agricultural chemicals. Dr. Smith assists **William T. Hack,** director of product development. He joined the company three years ago.

A fertilizer and feedstuffs department has been set up by **A. W. Horton & company,** of Los Angeles. **Frank F. Hochhausler** was appointed head of the department. Hochhausler has owned and operated his own companies, importing and exporting fertilizers and feedstuffs in Germany for 28 years.

Four appointments were announced recently in the plant food division of **International Min. & Chem. E. Meade Wilson** is new area manager at Mulberry, Fla.; **D. N. Barksdale** is assistant to Wilson; **W. P. Burke** is new district sales manager at Albany, Ga. and **S. Ralph Smith** succeeds Burke as area credit manager.

Raleigh office of **Potash Company of America** closed April 1, and **G. Albert Woods,** formerly sales representative in North and South Carolina, now has headquarters in Washington, D. C. He continues in charge of the Carolina-Virginia territory.

Died: Howard Marschutz, manager of Waterproof sales for **Bemis** since 1943, and employed by the company since 1916, March 10 after an automobile accident. Marschutz served two years in the Navy in World War I.

Interested in the new **Virginia fertilizer law?** Copies now are available, according to **Rodney C. Be ry** state chemist. They can be obtained by writing to Department of Agriculture and Immigration, Division of Chemistry, 1123 State Office Building, Richmond 19, Va. The 1951 **report on Economic Poisons** also is available in booklet form from the office.

P. D. Sanders, editor of the **Southern Planter,** helped spearhead the drive for the new law as a "farm measure." He said the legislation brings recommendations more in line with adjoining states and will be helpful to the fertilizer industry. The fertilizer law becomes effective July 1.

Between $150,000 and $200,000 was spent by Richardson County farmers, according to a survey made in 1951 at Falls City, Neb., for fertilizers and soil minerals. A **survey of dealers** there reveals that 2,200 tons of fertilizers were bought plus about 70,000 tons of anhydrous ammonia which was applied to about 1,700 acres.

Gro-Mo Fertilizer and Chemical company opened its doors at McCook, Neb., recently. **Don Dunscombe,** formerly of Clarkton, Mo., is new manager. **John T. Harris** is president of the company, which produces anhydrous ammonia fertilizer and handles other agricultural chemicals.

Possible construction of a sulfur plant in Big Horn basin of Wyoming to utilize output of **sour gas** from the new Five Mile area northwest of the Worland field in Big Horn County depends upon proof of adequate reserves for further drilling, **M. A. Machris** of Wilshire Oil company reported recently. **One well** now tested has assured production of large volume of gas with a sulfur content of 6.6 tons per million cubic feet.

Two new directors have been added by **Link-Belt. Robert C. Becherer,** executive vice president and **William J. Kelly,** president of Machinery & Allied Products institute were appointed to the board. Becherer was elected president to succeed George P. Torrence who retired.

Died: Robert C. Charlton, chief chemist and director of chemical control of the **American Agricultural Chemical** company, suddenly March 25. Charlton had been with the company for 32 years, starting in 1920 at the Baltimore plant.

New assistant manager of the Nitrogen Products sales section of DuPont's Polychemicals department is **Clarence D. Bell,** who succeeded **Dr. Frank G. Keenen.** Keenen is section manager. **Other changes: McKay Collette** was transferred from Nitrogen Products sales section in Mid West to Sales Promotion in Wilmington, Del.; **Vernon S. Peterson,** of Ames, Ia., replaced Collette.

Miami Fertilizer company isn't located in Miami, O. (a non-existent city) as reported in the February Briefly Noted. It's in Xenia.

No Time For Research

"You probably realize that there is very limited opportunity for one who is not in the professional field of soils research to voice an idea in public.

"The soils men have their journals, but you have to have a doctorate to get into them and have five years' experimental evidence to prove a point."

That's the way E. F. Dietz expressed his distress to FARM CHEMICALS about his difficulties in getting what he considers a worthwhile idea before scientific minds.

Mr. Dietz has been interested for several years in the world-wide shortage of sulfur and its hampering effect on the manufacture of farm chemicals.

He said he has talked to many research personnel about the situation and has given it constant thought on his farm in Madison, Wis.

What's more, he thinks he has a solution to the problem.

But, as he lamented to this magazine recently, "Unfortunately, I don't have the time to make the experiments to prove this thing out.

"And if I did, where would a guy who has to scrabble a living farming get the data published?"

The experiments to which he refers are concerned with a method of using phosphate rock that he says has not been recognized to date. It is a means of creating soluble phosphates in the soil and is based on a theoretical chemical reaction which can occur in a soil containing acid clay.

Mr. Dietz's theory is explained in detail in a letter to the editor appearing on page 33 of this issue.

A long correspondence between Mr. Dietz and staff members of FARM CHEMICALS preceded the printing of the letter.

In April, 1951, Mr. Dietz referred to an article in this magazine concerning the sulfur shortage and its implications in the ferti izer industry.

"It seems," he wrote, "that the demand for such a basic material as sulfur in the chemical and manufacturing industries of this country is going to increase faster than the supply can catch up, and consequently the cost of acid phosphate is going to continually cost more and more, and under allocations of sulfur, the material is going to be scarce no matter what the cost."

The writer said he was attempting to answer the call for new methods to combat the situation, for which an industry committee had asked.

FARM CHEMICALS thinks the letter from Mr. Dietz raises an important problem.

Not just the immediate one of finding a "new method" or new materials to alleviate the sulfur shortage.

Far more important, we think, it raises the problem of how a farmer or other person interested in the welfare of agriculture and the chemicals so vital to farming can get information, theories and ideas before the persons and organizations who could do something with them.

We are printing the letter not because we think Mr. Dietz has discovered a panacea for the sulfur situation. His theory may prove to have little merit —indeed, it even may be, as several research men have indicated, completely without value.

But Mr. Dietz and FARM CHEMICALS would like this "proof" to be based on experimental data before the idea is rejected point-blank.

This magazine is not and does not intend to be a sounding board for "crack-pot" ideas or pipe dreams. We are printing the letter because we think the experiment may be worthy of further investigation by members of the industry.

We wonder how many other farmers have had similar ideas or tentative experiments which they could not carry out in an exhaustive, scientific manner because they, like Mr. Dietz, have to "scrabble a living" farming?

The whole field of agriculture—on the farm and industry levels—might be benefited if these ideas are presented in magazines such as this one for the consideration and further development of industry research.

—HAMILTON C. CARSON

farm chemicals outlook

Report from Washington
by Fred Bailey & Don Lerch

There is growing confidence in Washington over this nation's ability to contain Russia militarily. This is not to deny serious weaknesses among NATO countries, and the peril of continued indecision in Korea and throughout Asia. However, mobilizers believe we now have the "stuff" to fight Russia if we have to.

"Stockpiled" productive capacity is the real key to Washington's optimism. There are scores of secret weapons to stave off an initial attack, but of greater importance according to officials here is our expanded ability to produce . . . and do it fast.

Officials show new concern over Russian efforts to hit us from within, however. They expect renewed communist attempts to capitalize on even a slight business recession. Prolonged labor disputes will provide more avenues for communist activity.

Washington feels the country is "ripe" for this type of assault. There are more apparent weaknesses on the home front than in our military machine. What's more, these weaknesses very probably will grow.

Prospect of deepening deflation is causing considerable concern here. Washington likes to talk about good times in an election year, but price weaknesses are continuing.

Even increased military production is not expected to do more than retard deflation in the months ahead. Current rate of military production is about two million dollars per month. Schedules call for an increase to $3\frac{1}{2}$ billion by the end of the year. Even though this would represent a sizeable increase in actual output, the tremendous increase in productive capacity should absorb the orders with little additional strain on the domestic economy.

Farmers appear to be taking a hand at slowing the downward trend of farm prices. They intend to plant smaller crops this year . . . one million acres under last year and $7\frac{1}{2}$ million acres under USDA goals. Sharpest cut is in feed grains, with farmers planning to plant 83.9 million acres in corn . . . five million acres under the goals.

Some European countries are completing deals with Russia for feed grains. They have been turned down here. Officials are unwilling to risk a further reduction in reserves. Apparently bullets are not the only way to penetrate an iron curtain.

Spot survey of private opinion on prospective cotton acreage shows two to one odds that farmers will plant considerably under the goal. This is not based on slow fertilizer sales in the South during the late winter and early Spring months, but on the concern of farmers over labor supplies and the risk involved in producing high-cost cotton.

USDA is soft pedaling the story, but official pressure is off a 16-million bale crop. Possibility that domestic and foreign demands will not take 16 million bales, plus the almost desperate need for expanded feed grain acreage, is dictating this policy change.

Extended strikes could retard deflation . . . create real shortages which would force prices up. But the possibility of such a spurt is viewed as a momentary lull in the course of deflation.

Farm chemical salesmen reporting an increase in credit selling are reflecting the deterioration of the farmers' net position. Long-term farm debt, chiefly for the purchase of farms or major improvements shows a 9.5 per cent increase during the

past year. Short term debt, for the purchase of production essentials, fertilizer, pesticides, farm machinery, has increased 20 per cent during the same period.

"Early returns" on the spring fertilizer season show a substantial increase after a slow start. USDA field reports are revealing shortages in some areas, particularly for certain forms of nitrogen, and, in some cases, straight superphosphate.

Officials feel the industry is stretching materials as far as possible by giving "priority" to mixed goods. Shortages of mixed goods are not showing up as often as for separate chemicals.

Washington believes industry will empty its bins if the demand continues throughout the season. Time lag from the factory to the field is being cut to a few hours for some materials. This is in contrast to earlier sales where fertilizer was hunting outside normal territory for markets.

USDA hopes the total sales show a substantial gain over a year ago. Increased fertilizer sales in a period of falling farm prices would bolster their hope that more farmers will be convinced of the value of plant food under any price level. Low-cost production through increased yields per acre is one of the points they are promoting.

Watch for more agencies of the department to get into the fertilizer act. Plans to "marry" a whole flock of bureaus into a fertilizer promotion campaign are gaining headway. Some have been in the field for years, but the new plan is department-wide.

Basic elements in the new plan involve both the action and educational agencies. PMA and SCS would add more drive to the educational and research activities of the Extension Service, Agricultural Research Administration and the Bureau of Agricultural Economics. All the agencies would contribute either facts or the selling force to demonstrate that increased use of fertilizer under recommended conditions is an almost sure way to make more money.

Department releases are putting more emphasis on the advantages of increased fertilizer usage. This is considered by many officials as only the beginning . . . there's more to come and over a long period of time. Talk is for a five-to-ten year program.

Official statements won't go this far . . . but privately many department men say it's either more fertilizer or not enough food to meet our growing population. While this view may be somewhat of an exaggeration . . . Washington is not accustomed to the prospect of anything but abundant food supplies except in all-out war.

Washington still feels it has not sold its case to the entire fertilizer industry. Nonetheless, it is going to promote fertilizers to the limit . . . take its case directly to the farmers and the public.

Nitra-phosphate processes are attracting increasing interest with several new plants reportedly in advanced stages of planning. Site for one large new plant is alleged to be the Mid West with Chicago a probability. Little public information of the extent of plant construction for new process production can be expected, until companies complete plans and receive necessary material allocations from Washington. For this reason, it will be difficult to judge the potential production from this new development.

There's more than talk behind Washington's alarm on insect resistance. Entomologists who have steadfastly stuck to their recommendations for greater use of mechanical controls are finding a chance to drive home their points. Mechanical methods for controlling mosquitos again are being recommended, particularly for large-scale control.

Latest government survey shows farmers will need 9 per cent more pesticides this year. Actual consumption may vary considerably from estimates because the survey was taken long before the season opened and during a period when fear of shortages was more apparent than now. Industry's expansion program is expected to meet anything but the demands of an abnormal insect year. Substitute may be necessary in some cases.

Here come the bugs!
For areas and control,
read Farm Chemicals'

Pest Survey

By John Harms
FARM CHEMICALS
Washington Correspondent

FARMERS are relying heavily on chemistry as a principal means for attaining tremendous increases in food, feed and fiber yields needed to feed and clothe a population that is increasing by more than two million persons a year.

They see chemistry as occupying a dual role in the drive for higher yields. On the one hand it must supply the plant nutrients needed to increase yields per acre. On the other it is depended upon to provide the pesticides which are required to protect the plants against insects and diseases.

Agricultural officials see chemicals as occupying the most important single role in the drive for expanded production. There is only a limited amount of new land which can be brought into production, so science must provide the new frontier for agriculture.

Role of Chemistry

Chemistry will continue to play an increasingly important role in the struggle of man to produce food and fibers and protect their growth against insects and other pests. An up-to-the-minute survey of crop tests and recommended methods for combatting them has been obtained exclusively by FARM CHEMICALS through official sources. The Department of Agriculture is prepared to back a new use-more-pesticide program among farmers. It is expected to emphasize specific control programs for various pests.

Although specific figures are not available best obtainable estimates from official sources indicate that for every $1 spent for pesticides the average return in higher yields is about $10.

Hordes of insects rob the Nation of an average of not less than $4 billion worth of farm commodities each year. That's about a third of the annual net income of all farmers and twice as much as wages paid in one year to farm laborers. In 1951 cotton insects chewed up almost one billion dollars worth of cotton, the European corn borer eating about $53 million worth of corn. These are only a couple of more than 100 major crop pests which descend on farm lands every year.

USDA Surveys

The $4 billion loss estimated for 1951 by the government admittedly is a conservative one. Private entomologists say it's as high as $15 billions, or as much as the 1951 net earnings of farmers. Some estimates go even higher.

The U. S. Department of Agriculture figures, on the basis of early spot surveys, that insect infestations might be a little lighter this year than last. But they don't promise anything. If the weather during the coming growing season is more favorable than average to insect development, losses to insects would soar to even greater heights.

A department survey shows farm demand for the older, established kinds of pesticides will be about the same as the last several years, but demand for the newer types will average 25 per cent higher than a year ago.

Future Demand?

That estimate is only for this year. What will the demand be next year? What about the years after that? A good estimate could be made on the basis of what farm production will be in the years to come. U. S. population is expected to grow steadily to at least 190 million by 1975. Farm production must be increased by at least 30 per cent to meet bigger population needs. Farming will be more intensive to increase yields per acre, for there are relatively few new acres open to farming. This points to greater stress on high-power pesticides to keep the robber bugs off to permit higher yields. Future markets for not only chemical pesticides, but chemical fertilizers as well, should continue to climb.

The bugs are by no means discouraged, nor do they show signs of becoming discouraged. In addition to the hundreds of different kinds of bugs already established in the U. S., hundreds of others are just itching to come to the land of milk and honey. From time to time some of these aliens do sneak in causing severe emergencies because they leave their natural enemies behind.

Following is an officially approved survey of 20 major robber bugs, their prevalence and pesti-

cide measures needed to combat them.

Grasshoppers and Mormon crickets: Although grasshoppers are distributed over the entire U. S., the more damaging infestations occur in arid or semi-arid states of the West. They are general feeders, sparing no vegetation when occurring in outbreak numbers. In epidemic years damage goes above $100 million and in average years it runs to $30 million. Sprays and baits of Chlordane, Toxaphene, Aldrin and Dieldrin are recommended anti-measures.

European corn borer: Infestation ranges from New Jersey to Montana and from Pennsylvania to Alabama. Although infestations this year are not as heavy as formerly, they are spreading to new states. The corn borer caused an estimated damage of $53 million in 1951. Sprays of DDT and Ryania are effective against it.

White fringed beetle: Infests eight southern states and is a potential threat to entire southern half of U. S. Feeds on some 200 species of plants, including cotton, tobacco, peanuts, corn, sugar cane, sweet potatoes, clover and numerous vegetables. Recommended measures include soil treatments and foliage sprays of DDT or Dieldrin.

Chinch bug: A general pest of wheat and corn, but is particularly bothersome in mid-west states. Losses to this insect mount into the millions of dollars in severe years. Successful pesticides include DDT, rotenone, sabadilla, nicotine, Toxaphene and Chlordane.

Greenbug: Mainly in Kansas, Oklahoma and Texas, but also in other states such as Colorado and New Mexico. Chiefly a wheat pest, it's also hungry for oats, barley and rye. Several million acres are threatened or destroyed each year. Parathion and TEPP are used.

Lygus bugs: Chew through alfalfa fields from Wisconsin through California. Control measures include DDT and Toxaphene.

Pink bollworm: Most destructive cotton pest, destroys blossom, seed and lint. Has invaded more than 190 Texas counties, and some in Arizona, New Mexico, Oklahoma and Louisiana. Destroyed about $900 million worth of cotton in 1951. Spray or dust DDT, BHC and Parathion.

Boll weevil: Has infested most southern cotton areas, with most serious recent infestations in Oklahoma, Arkansas and parts of Missouri and Tennessee. Damage last year expected to be less serious than in 1949 and 1950. Anti-measures include calcium arsenate, BHC, Parathion, Toxaphene, Aldrin and Dieldrin, Chlordane.

Screw worm fly: Lays maggot eggs in open wounds of man and livestock. Prevalent in southeastern states and Southwest. Generally, infestations in 1951 were light because of adverse weather. Remedy is EQ-355 (Lindane).

Citrus black fly: No known infestations in the U. S., but threatens continually from Mexico. Attacks more than 150 species of plants, including oranges, grapefruit, all varieties of citrus, avacado, mango, persimmon, pear and quince. Heavily infested trees die within three years. DDT and rotenone are recommended.

Oriental fruit moth: Dangerous to peach and apple orchards. Recently reported in Massachusetts, Washington, Cumberland-Shenandoah valley, Georgia, Indiana, Ohio, North Carolina and New Jersey. DDT, Parathion and EPN are combat measures.

Japanese beetle: This pest infests 6 per cent of U. S. land area, including 16 northeastern states. It feeds on at least 200 different plants. Effective control measures include DDT, Methoxychlor, rotenone, lead arsenate.

Mexican fruit fly: Domestic infestation is confined to eight citrus counties in Texas but widely established in nearby Mexican areas. Average losses in Mexico are 30 per cent for oranges, mangoes, guavas and higher for grapefruit.

Codling moth: Causes considerable damage to orchards each year throughout the apple growing regions. DDT is the most common protector.

Gypsy moth: Now confined to New England and eastern New York. If permitted to spread unhampered it could cause serious damage throughout hardwood area east of the Mississippi River. Controlled by DDT and oil solution.

Engelmann spruce beetle: Destroyed $10 million worth of timber in Colorado and intangible damage to watershed and recreation areas. Individual trees must be sprayed with Orthodichlorobenzene.

Sweet-potato weevil: Presently established in seven of 22 sweet-potato producing states: Alabama, Florida, Georgia, Louisiana, Mississippi, South Carolina and Texas. DDT and Methoxychlor used in storage.

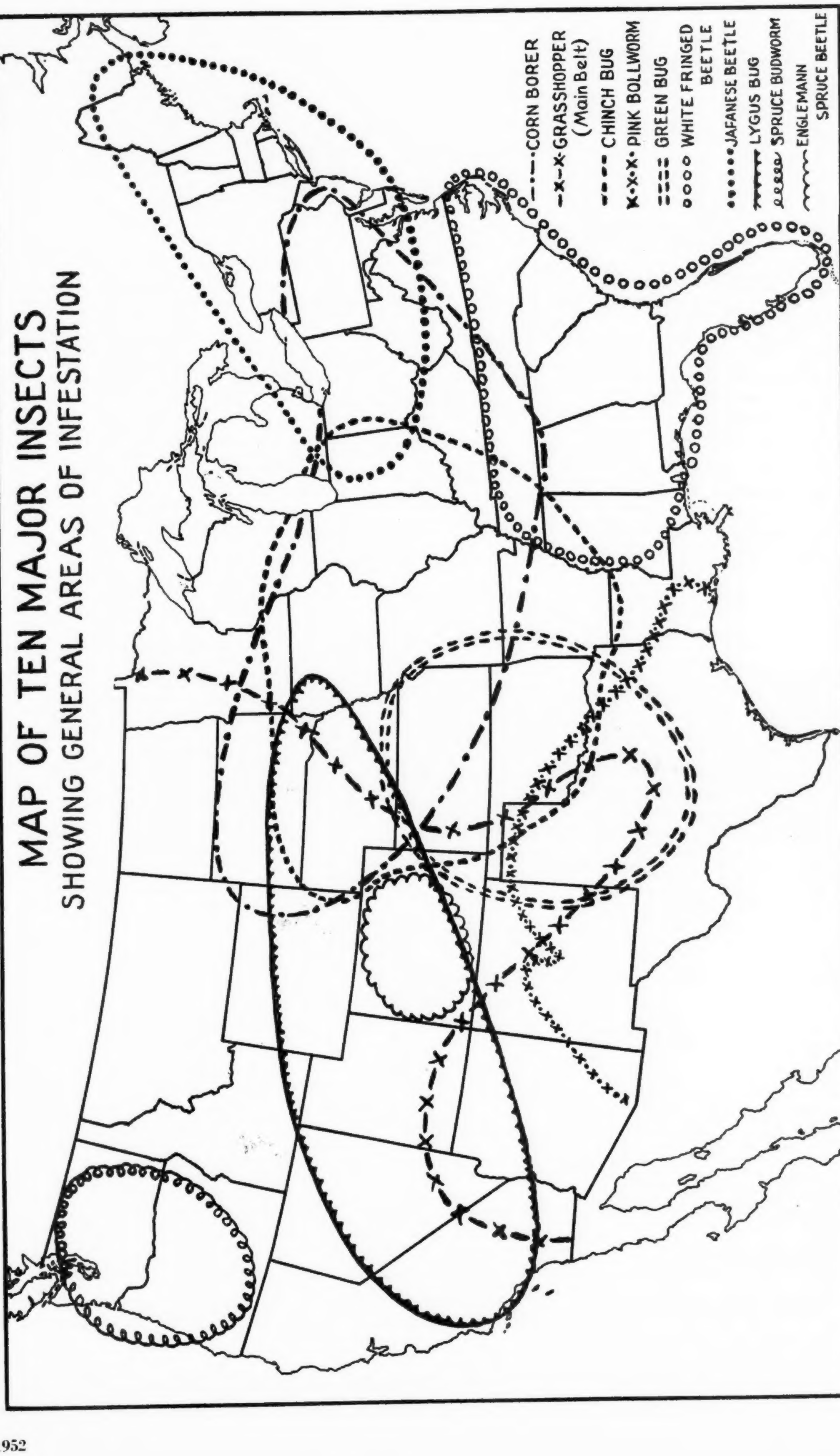
Spruce budworm: Epidemic in Douglas fir and white fir forests of Oregon and Washington covers about two and one-quarter acres. It threatens standing timber valued at $63 million. Airplane sprays of DDT and oil solution are used.

Pests of stored grains: Untold millions of dollars lost every year to various insects infesting grain bins in all areas of the U. S. Control measures include DDT, Methoxychlor, Pyrethrum, ethylene dichloride, carbon tetrachloride.

Plum curculio: Pest of peaches, plums, apples, cherries. Control by use of lead arsenate, Methoxychlor, Parathion. ◆

Pest 'Appointments'

Grasshopper	**Mar.-Nov.**
European corn borer	**June-Sept.**
White fringed beetle	**April-Oct.**
Chinch bug	**June-Sept.**
Greenbug	**Feb.-June**
Lygus bugs	**May-Sept.**
Pink boll-worm	**June 15-Aug. 1**
Boll weevil	**July 1-Sept. 15**
Screw worm fly	**May-Oct.**
Citrus black fly	**All year**
Oriental fruit moth	**May-Sept.**
Japanese beetle	**June 15-Aug. 15**
Mexican fruit fly	**All year**
Codling moth	**May-Sept.**
Gypsy moth	**June-July**
Engelmann spruce beetle	**June 15-July 31**
Sweet-potato weevil	**All year**
Spruce bud-worm	**June 15-July 31**
Pests of stored grain	**All year in South, warm weather only in North**
Plum curculio	**April-July**


MAP OF TEN MAJOR INSECTS
SHOWING GENERAL AREAS OF INFESTATION
CORN BORER
GRASSHOPPER (Main Belt)
CHINCH BUG
PINK BOLLWORM
GREEN BUG
WHITE FRINGED BEETLE
JAFANESE BEETLE
LYGUS BUG
SPRUCE BUDWORM
ENGLEMANN SPRUCE BEETLE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REG. U.S. PAT. OFF.
THREE ELEPHANT
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LOS ANGELES 54, CALIF.

Data on chemical content of plant nutrients given in 1949-1950 survey of

Mixed Fertilizers

By K. G. Clark and W. M. Hoffman*

A SURVEY of mixed fertilizers marketed in the United States during the 1949-1950 fertilizer season was conducted for the purpose of obtaining information on several phases of their chemical composition. This paper gives information on different forms of phosphorus. Data on carbonate content, acidity-basicity and acid-insoluble ash will be reported in the June issue of FARM CHEMICALS.[1]

To make the survey as representative as possible the selection of samples from each major geographical region was based on the tonnage of the several grades marketed and on the production of individual manufacturers. Selections were based on the latest seasons for which necessary information was available—1943–1944 for production of more than 8,400,000 tons of mixtures by 675 individual manufacturers[2] and 1947–1948 for approximately 11,940,000 tons marketed as 613 different grades.[3]

Principal grades were represented by at least one sample for each 50,000 tons of the grade marketed. Samples were taken so that each manufacturer producing 25,000 tons or more of mixtures annually was represented by at least one sample. Other producers were included by random selection of a sample for each four manufacturers.

State fertilizer control officials cooperated by supplying 1949–1950 official inspection samples of the desired grades marketed by the specified manufacturers. Thus, 420 samples of mixtures representing 87 grades, 57 plant-nutrient ratios and 157 manufacturers were obtained from 25 States. Control officials also supplied, for comparison with the mixtures, 92 samples of seven grades of superphosphate marketed by 57 manufacturers. Fourteen of the superphosphates represented the products of 13 manufacturers not otherwise represented in the survey.

Distribution of both superphosphates and phosphorus-containing mixtures in relation to the numbers of states, samples, grades, plant-nutrient ratios and manufacturers is presented in table 1. Table 2 shows distribution of samples among the P, N-P, P-K and N-P-K classifications in relation to the number of manufacturers and the number of samples representing each manufacturer. The 11 grades—2-12-6, 3-9-6, 3-12-6, 3-12-12, 4-8-6, 4-10-6, 4-10-7, 4-12-4, 5-10-5, 5-10-10 and 6-8-4—were represented by at least 10 samples each for a total of 244 of the 373 samples of N-P-K mixtures.

Analytical Methods—Total, water-soluble and citrate-insoluble P_2O_5 contents of official inspection samples were determined in accordance with official methods of analysis prescribed by the Association of Official Agricultural Chemists.[4] In most instances unground samples were available and in such cases analyses were conducted on freshly ground mixtures.

Analytical Results—Wider variations and lower mean values were observed in the water-soluble and in the available (total minus citrate insoluble) portions of the total phosphorus in mixtures than in superphosphates. Analytical data for each region are summarized in table 3 in relation to superphosphates and to classes of mixtures.

Water-soluble Portion of P_2O_5—Water-soluble portion of the P_2O_5 content of the superphosphates ranged from 56.0 to 92.7 per cent and averaged 81.9 per cent. Averages for individual states ranged from 73.7 to 89.2 and for regions from 77.0 to 84.3 per cent.

In comparison, water-soluble

[1]Senior Chemist and Associate Chemist, Division of Fertilizer and Agricultural Lime, respectively.

Contribution from the Bureau of Plant Industry, Soils and Agricultural Engineering, Agricultural Research Administration, U. S. Department of Agriculture, Beltsville, Md.

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Table 1.—Distribution of Samples in Relation to Region and Numbers of States, Grades, Plant-nutrient Ratios and Manufacturers

		Superphosphates			Phosphate Mixtures			
Region	States	Grades	Mfgs.	Samples	Grades	Plant Nutrient Ratios	Mfgs.	Samples
New England	3	3	9	12	16	10	18	34
Mid. Atlantic	4	2	13	17	13	12	26	50
S. Atlantic	4	3	11	15	26	23	54	117
E. S. Central	3	2	11	11	12	12	26	48
W. S. Central	2	1	7	8	8	8	16	23
E. N. Central	3	1	9	12	15	10	33	81
W. N. Central	2	3	8	8	16	10	17	30
Mountain	2	3	4	4	10	10	11	20
Pacific	2	2	5	5	14	13	14	17
U. S.	25	7	57	92	87	57	157	420

Table 2.—Distribution of Samples in Relation to Manufacturers

Number samples per mfgr.	Super-phosphates		Classification of mixtures by grades: N-P		P-K		N-P-K		All mixtures	
	Mfgs.	Samples	Mfgs.	Samples	Mfgs.	Samples	Mfgs.	Samples	Mfgs.	Samples
1	42	42	10	10	15	15	95	95	95	95
2	8	16	5	10	3	6	25	50	30	60
3	2	6	1	3	1	3	8	24	12	36
4	2	8	—	—	—	—	4	16	5	20
5	1	5	—	—	—	—	3	15	5	25
6–10	2	15	—	—	—	—	3	24	3	25
11–20	—	—	—	—	—	—	3	48	2	31
>20	—	—	—	—	—	—	4	101	5	138
Tot.	57[1]	92	16	23	19	24	145	373	157	420

[1]Forty-four of these manufacturers marketed 78 of the superphosphates and 246 of the mixtures; 13 marketed 14 of the superphosphates but none of the mixtures.

portion of total P_2O_5 content of the mixtures ranged from 2.6 to 93.2 and averaged 46.9 per cent. Averages for individual states ranged from 33.2 to 71.1 and for regions from 35.2 to 70.7 per cent. Less than 10 per cent of total P_2O_5 was present in water-soluble form in one N-P, two P-K and 10 N-P-K mixtures—each of which was produced by a different manufacturer.

N-P mixtures exhibited least variation in proportion of their total P_2O_5 in water-soluble form, 23.9 to 93.2 per cent, and the highest mean value—68.9 per cent. State means varied from 39.0 to 86.6 per cent and regional means from 39.0 to 75.8 per cent.

P-K mixtures showed somewhat greater variation, 9.4 to 86.6 per cent, than the N-P mixtures and a lower mean—54.5 per cent. State means ranged from 25.5 to 86.6 per cent and regional means from 25.5 to 78.8 per cent.

N-P-K mixtures exhibited greatest variation, 2.6 to 92.9 per cent, and the lowest mean value—45.1 per cent. State means ranged from 33.2 to 83.3 per cent and regional means from 35.6 to 67.5 per cent.

Available Portion of P_2O_5: Available portion of the P_2O_5 in superphosphates varied from 86.7 to 100.0 per cent and averaged 96.8 per cent. Averages for individual states varied from 93.9 to 99.4 and for regions from 94.7 to 97.8 per cent.

In comparison, available portion of the P_2O_5 in the mixtures varied from 50.6 to 99.9 and averaged 93.0 per cent. Averages for individual states varied from 90.3 to 97.5 and for regions from 91.5 to 95.9 per cent.

N-P mixtures exhibited somewhat greater variation in P_2O_5 availability, 76.7 to 99.5 per cent, than P-K mixtures and the highest mean value—95.2 per cent. State and regional means varied from 91.7 to 97.0 per cent.

P-K mixtures exhibited appreciably less variation, 81.3 to 99.4 per cent, than the N-P-K mixtures and substantially the same mean—95.0 per cent. State means varied from 88.7 to 99.4 per cent and regional means from 88.7 to 97.9 per cent.

N-P-K mixtures exhibited greatest variation, 50.6 to 99.9 per cent, and the lowest mean value—92.8 per cent. State means varied from 86.7 to 98.9 per cent and regional means from 91.5 to 96.8 per cent.

Water-soluble Portion of Available P_2O_5—Water-soluble portion of the available P_2O_5 in superphosphates ranged from 58.6 to 92.7 and averaged 84.5 per cent. Averages for individual states ranged from 78.5 to 89.8 and for regions from 81.3 to 87.4 per cent.

In comparison, water-soluble portion of the available P_2O_5 in the mixtures ranged from 2.8 to 99.7 and averaged 50.2 per cent. Averages for individual states varied from 35.3 to 74.0 and for regions from 37.9 to 73.6 per cent.

N-P mixtures exhibited least variation in the water-soluble portion of available P_2O_5, 26.5 to 94.1 per cent, and the highest mean value—72.0 per cent. State means varied from 41.5 to 89.3 per cent and regional means from 41.5 to 77.9 per cent.

P-K mixtures showed somewhat greater variation, 10.4 to 87.1 per cent, than the N-P mixtures and an appreciably lower mean—56.9 per cent. State means varied from 27.4 to 87.1 per cent and regional means from 27.4 to 80.5 per cent.

N-P-K mixtures exhibited the greatest variation, 2.8 to 99.7 per cent, and the lowest mean value—48.4 per cent. State means varied from 35.3 to 84.3 per cent and regional means from 38.4 to 69.5 per cent.

Solubility and Availability of the P_2O_5 in Superphosphates and in Mixtures—As indicated earlier and in table 3, water-soluble and available portions of the total P_2O_5 averaged 81.9 and 96.8 per cent, respectively, in superphosphates and 46.9 and 93.0 per cent in mixtures. The lower availability of the P_2O_5 in the mixtures appears to have been sufficiently well assessed by manufacturers to permit the guarantee for available phosphoric acid to be met by inclusion in the formula of somewhat greater quantities of superphos-

phate than otherwise would be required. Thus, the mean values for the percentage of the guaranteed available P_2O_5 found to be present on analysis ranged from 100.3 in the West South Central region to 106.0 per cent in the Mountain region and averaged 102.5 per cent for all regions.

Solubility and availability characteristics of the P_2O_5 differed appreciably among the various superphosphates and mixtures as well as between the two classes of materials themselves. The P_2O_5 in the mixtures, as shown in table 4, was more widely distributed with respect both to water solubility and to availability than in the superphosphates. Approximately 78 per cent of the superphosphates in comparison to 38.0 per cent of the mixtures contained 95 per cent or more of the total P_2O_5 in available form.

Similarly, the available portion of the P_2O_5 was 90 per cent or more in 97.8 per cent of the superphosphates and 86.2 per cent of the mixtures. Slightly more than 90 per cent of the superphosphates but only 7.4 per cent of the mixtures contained 80 per cent or more of the available P_2O_5 in water-soluble form. None of the superphosphates contained less than 58.6 per cent of the available P_2O_5 in water-soluble form, whereas in nearly one-half of the mixtures (49.0 per cent) less than 50 per cent of the available P_2O_5 was water soluble.

Lower Values

The lower values for water solubility and availability of the P_2O_5 in the mixtures may be attributed to formulation practices involving ammoniation, and incorporation of considerable quantities of liming materials to offset the acid-forming properties of other ingredients and as make-weight material.

Considering superphosphate as the sole source of P_2O_5 in the mixtures, it appears that on the average 96.1 per cent of the originally available P_2O_5 remained in available form after formulation of the mixtures whereas only 57.3 per cent of the water-soluble P_2O_5 was still water soluble.

Regional averages for the re-

Table 3.—Percentage of Total P_2O_5 in Water-Soluble and in Available Form

Region	Number samples	Portion of total P_2O_5 in: Water-soluble form		Available form		Portion avail. P_2O_5 in water-soluble form	
		Range	Mean	Range	Mean	Range	Mean
		Per Cent					
New England							
Super	12	69.5–88.7	79.7	90.4– 99.7	96.1	76.3–90.4	82.8
All mixtures	34	2.6–86.6	44.6	89.0– 99.7	95.9	2.8–87.1	46.2
N-P grades	1	———	39.0	———	94.2	———	41.5
P-K grades	3	71.3–86.6	78.8	96.8– 99.4	97.9	73.1–87.1	80.5
N-P-K grades	30	2.6–76.1	41.3	89.0– 99.7	95.7	2.8–87.1	43.0
Mid. Atlantic							
Super	17	78.2–89.0	83.7	93.5– 99.9	97.6	83.1–89.2	85.8
All mixtures[1]	50	12.0–81.3	49.7	90.5– 99.9	94.6	12.8–82.5	52.5
P-K grades	2	67.0–77.0	72.0	95.9– 98.8	97.3	67.8–80.3	74.0
N-P-K grades	48	12.0–81.3	48.8	90.5– 99.9	94.4	12.8–82.5	51.6
S. Atlantic							
Super	15	77.7–86.9	82.9	97.1–100.0	97.8	84.1–89.2	84.8
All mixtures	117	4.5–70.3	39.8	50.6– 99.3	91.5	6.7–75.0	43.6
N-P grades	1	———	57.5	———	91.7	———	62.7
P-K grades	1	———	58.5	———	96.5	———	60.6
N-P-K grades	115	4.5–70.3	39.5	50.6– 99.3	91.5	6.7–75.0	43.3
E. S. Central							
Super	11	57.6–92.7	82.1	86.7–100.0	97.5	58.6–92.7	84.3
All mixtures[1]	48	4.1–57.9	35.2	65.2– 99.2	91.6	5.5–69.2	37.9
P-K grades	2	9.7–41.2	25.5	81.3– 96.2	88.7	11.9–42.9	27.4
N-P-K grades	46	4.1–57.9	35.6	65.2– 99.2	91.7	5.5–69.2	38.4
W. S. Central							
Super	8	77.7–91.6	84.0	93.9– 99.8	97.2	80.3–91.8	86.4
All mixtures	23	15.4–84.5	51.3	85.6– 96.8	92.1	18.0–88.2	55.5
N-P grades	2	48.6–67.1	57.9	91.8– 95.0	93.4	51.1–73.2	62.1
P-K grades	1	———	76.0	———	94.5	———	80.4
N-P-K grades	20	15.4–84.5	49.4	85.6– 96.8	91.8	18.0–88.2	53.6
E. N. Central							
Super	12	61.5–86.4	77.0	89.6–100.0	94.7	66.5–87.6	81.3
All mixtures[1]	81	9.4–72.8	50.7	82.0– 98.3	92.7	10.4–99.7	54.6
P-K grades	12	9.4–76.6	45.6	90.8– 97.8	94.9	10.4–80.6	47.8
N-P-K grades	69	19.9–92.9	51.6	82.0– 98.3	92.3	24.2–99.7	55.8
W. N. Central							
Super	8	56.0–90.9	82.4	93.0– 99.8	97.0	60.2–92.3	84.8
All mixtures[1]	30	8.8–85.1	52.1	88.2– 99.1	94.1	9.8–85.9	55.1
P-K grades	3	54.7–73.0	65.3	92.5– 98.2	94.7	59.1–74.4	68.9
N-P-K grades	27	8.8–85.1	50.6	88.2– 99.1	94.0	9.8–85.9	53.6
Mountain							
Super	4	80.7–89.8	84.3	94.7– 99.8	96.4	84.3–90.0	87.4
All mixtures[2]	20	23.9–93.2	70.7	76.7– 99.7	95.6	26.5–94.1	73.6
N-P grades	16	23.9–93.2	71.5	76.7– 99.1	95.3	26.5–94.1	74.6
N-P-K grades	4	46.4–84.2	67.5	94.4– 99.7	96.8	48.8–85.8	69.5
Pacific							
Super	5	74.6–87.5	83.2	93.2– 97.9	96.2	80.1–89.7	86.4
All mixtures[2]	17	9.6–84.9	64.6	91.1– 99.5	95.8	10.3–85.7	66.8
N-P grades	3	63.3–84.9	75.8	92.6– 99.5	97.0	68.3–85.4	77.9
N-P-K grades	14	9.6–84.1	62.2	91.1– 98.1	95.5	10.3–85.7	64.5
United States							
Super	92	56.0–92.7	81.9	86.7–100.0	96.8	58.6–92.7	84.5
All mixtures	420	2.6–93.2	46.9	50.6– 99.9	93.0	2.8–99.7	50.2
N-P grades	23	23.9–93.2	68.9	76.7– 99.5	95.2	26.5–94.1	72.0
P-K grades	24	9.4–86.6	54.5	81.3– 99.4	95.0	10.4–87.1	56.9
N-P-K grades	373	2.6–92.9	45.1	50.6– 99.9	92.8	2.8–99.7	48.4

[1]No N-P grades collected.
[2]No P-K grades collected.

sidual available P_2O_5 ranged from 93.6 for the South Atlantic states to 99.9 per cent for New England. Similarly, regional averages for the residual water-soluble P_2O_5 ranged from 42.9 for the East South Central states to 83.9 per cent for the Mountain states. In general, higher averages were observed for those regions in which a greater proportion of the phosphate supply is available as concentrated superphosphate or in forms other than superphosphate. Conversely, the lower average values were associated with regions in which ammoniation and formulation of physiologically neutral mixtures are more extensively practiced.

Principal Mixed Fertilizer Grades—Data on the distribution of the P_2O_5 between water-soluble and available forms are summarized in table 5 in which the 11 principal grades representing 58 per cent or 244 of the 420 samples analyzed are listed in order of increasing percentages of available P_2O_5 in water-soluble form.

Although considerable variation exists for each grade in the distribution of P_2O_5 between water-soluble and available forms, listing in order of increasing percentages of total P_2O_5 in water-soluble form requires only the interchange of the 2-12-6 and 5-10-10 grades.

It will be noted that the general tendency is for the water-soluble fraction of the total and of the available P_2O_5 to increase as the P_2O_5 grade of the mixture increases and as the ratio of N to P_2O_5 decreases. The portion of the total P_2O_5 in available form also tends to be greater for the lower N to P_2O_5 ratios than for the higher ones.

Show Pressure

These relationships reflect the economic pressure on manufacturers to derive a high proportion of the total nitrogen from relatively inexpensive ammoniating solutions. Thus, one of the familiar NH_3-NH_4NO_3 solutions may be used to supply all of the nitrogen in 2-12-6, 3-12-6 and 3-12-12 grades without exceeding an ammoniation rate of 27 pounds of neutralizing NH_3 per 1000 pounds of super-

Table 4.—Distribution of Samples in Relation to the Solubility and Availability of P_2O_5

Water-soluble percentage avail. P_2O_5	Available portion of total P_2O_5 — Range, per cent: 50.0–59.9	60.0–69.9	70.0–79.9	80.0–89.9	90.0–94.9	95.0–100.0	Tot.
	Per cent of total samples						
	Superphosphates						
50.0– 59.9	—	—	—	—	—	1.1	1.1
60.0– 69.9	—	—	—	—	2.2	—	2.2
70.0– 79.9	—	—	—	1.1	3.2	2.2	6.5
80.0– 89.9	—	—	—	1.1	14.1	66.3	81.5
90.0–100.0	—	—	—	—	—	8.7	8.7
Total	—	—	—	2.2	19.5	78.3	100.0
	All Mixtures						
2.8– 9.9	—	—	0.5	1.0	0.7	0.2	2.4
10.0– 19.9	0.2	—	—	.7	4.1	.5	5.5
20.0– 29.9	—	0.2	—	2.1	4.3	.7	7.3
30.0– 39.9	—	—	—	2.4	7.1	2.4	11.9
40.0– 49.9	—	.7	.2	1.0	11.7	8.3	21.9
50.0– 59.9	—	.5	.2	2.9	9.0	7.1	19.7
60.0– 69.9	—	—	—	.5	7.9	9.3	17.7
70.0– 79.9	—	—	—	—	1.7	4.5	6.2
80.0– 89.9	—	—	—	.5	1.2	4.8	6.5
90.0–100.0	—	—	—	.2	.5	.2	.9
Total	0.2	1.4	.9	11.3	48.2	38.0	100.0

Table 5.—Distribution of Total P_2O_5 in Water-Soluble and in Available Form in Relation to 11 Principal Grades

Grade	Number samples	Portion of total P_2O_5 in: Water-soluble form, Range	Water-soluble form, Mean	Available form, Range	Available form, Mean	Portion available P_2O_5 in water-soluble form, Range	Mean
		Per cent					
6-8-4	12	4.7–62.4	28.6	86.4–96.1	92.6	5.5–65.5	30.6
4-10-6	25	15.6–53.8	34.1	82.5–96.9	91.9	16.8–59.4	37.2
4-8-6	18	4.5–54.6	34.6	71.0–99.3	90.7	5.5–59.9	37.7
4-10-7	10	19.5–63.3	37.6	86.6–97.5	93.5	20.7–66.8	40.0
5-10-5	27	4.1–84.5	41.8	72.8–98.2	92.8	5.7–88.2	44.7
3-9-6	22	8.4–70.3	42.5	65.2–97.4	92.4	9.4–75.0	45.3
4-12-4	17	15.4–62.3	43.0	85.6–96.7	91.4	18.0–68.8	46.9
3-12-6	27	28.4–68.3	47.3	90.6–98.2	94.1	30.9–71.8	50.2
5-10-10	18	17.3–72.9	47.7	89.0–98.0	94.9	18.2–76.9	50.2
2-12-6	51	8.8–92.9	47.4	82.0–98.2	91.4	9.8–99.7	51.8
3-12-12	17	31.2–78.5	54.8	85.3–98.3	93.3	36.6–81.7	58.4
Total	244	4.1–92.9	42.9	65.2–99.3	92.5	5.5–99.7	46.2
76 other grades	176	2.6–93.2	52.4	50.6–99.9	93.7	2.8–99.7	55.8
Total	420	2.6–93.2	46.9	50.6–99.9	93.0	2.8–99.7	50.2
11 grade means	244	28.6–54.8	42.9	90.7–94.7	92.5	30.6–58.4	46.2

Table 6.—Distribution of Total P_2O_5 in Water-Soluble and in Available Form in Relation to Nitrogen Grade

N Grades	Samples: No.	Samples: Weighted average grade	Portion of total P_2O_5 in: Water-soluble form, Range	Water-soluble form, Mean	Available form, Range	Available form, Mean	Portion available P_2O_5 in water-soluble form, Range	Mean
			Per cent					
0	24	0–15.33–12.25	9.4–86.6	54.5	81.3–99.4	95.0	10.4–87.1	56.9
2	53	2–11.79–6.04	8.8–92.9	47.3	82.0–98.2	91.7	9.8–99.7	51.5
3	79	3–11.08–7.96	8.4–80.0	48.8	80.8–98.3	93.2	9.4–86.3	52.0
4	116	4–10.26–6.21	4.5–81.3	40.9	50.6–99.9	91.5	5.5–82.5	44.8
5	58	5–9.91–7.78	2.6–84.5	43.2	63.0–99.5	93.0	2.8–88.2	45.5
6	45	6–9.42–6.40	2.8–84.2	41.6	76.7–99.0	96.1	2.9–85.8	42.7
8	15	8–10.00–10.13	34.1–85.1	59.6	85.7–99.7	95.3	37.2–85.9	62.2
10	22	10–13.00–2.86	23.9–85.1	68.4	90.2–99.7	96.3	26.5–86.8	70.9
Sub-Total	412	4.14–10.90–7.05	2.6–92.9	46.5	50.6–99.9	92.9	2.8–99.7	49.8
6 other grades	8	12.63–7.00–3.38	76.7–93.2	69.3	92.0–99.5	98.0	77.5–94.1	70.4
Total	420	4.30–10.83–6.98	2.6–93.2	46.9	50.6–99.9	93.0	2.8–99.7	50.2
8 grade means	412	4.14–10.90–7.05	40.9–68.4	46.5	91.5–96.3	92.9	42.7–70.9	49.8

phosphate, whereas with the exception of the 6-8-4 grade all the other grades listed would require ammoniation rates of 36 to 54 pounds. The 54-pound ammoniation rate would supply two-thirds of the nitrogen in the 6-8-4 grade and all of the nitrogen in the 4-8-6, 5-10-5 and 5-10-10 mixtures.

Grades According to Nitrogen Content—In table 6 data are summarized in relation to principal N grades of the mixture. The table shows that the portion of the total P_2O_5 in water-soluble and in available form in superphosphate decreases appreciably in the formulation of P-K as well as N-P-K mixtures. Presumably in the case of the P-K mixtures the observed decreases result largely from the incorporation of liming materials.

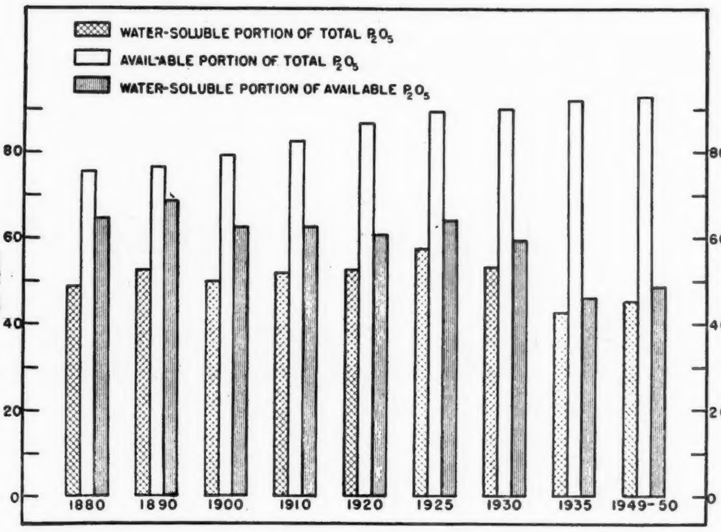
Lower Values

The 4, 5 and 6 per cent N grades show lower values for the portion of the total and of the available P_2O_5 in water-soluble form than either the lower or higher N grades. This indicates that in general higher rates of ammoniation are employed in the formulation of 4, 5 and 6 per cent N grades than in the formulation of the other grades.

Relative Solubility of P_2O_5 in Commercial Mixed Fertilizers, 1880-1950—Relative solubility of the P_2O_5 content of N-P-K commercial mixed fertilizers as determined in the present survey is compared with similar information covering the period 1880–1935[5] in figure 1. Although data for the years prior to 1949–1950 probably are not as completely representative of the entire country as those obtained in the present survey, nevertheless they indicate that the portion of the total P_2O_5 in water-soluble form increased from about 49 per cent in 1880 to about 57 per cent in 1925, and then decreased to 42.6 per cent in 1935 and 46.9 per cent in 1949–1950 following development and increased utilization of ammoniating solutions.

Available portion of the total P_2O_5 increased gradually from 75.5 per cent in 1880 to 93.0 per cent

Phosphorus Content of Fertilizers



in 1949–1950. This continued increase probably is due to decrease in the portion of the P_2O_5 derived from organic materials and to process improvements in the production of superphosphate. Between 1925 and 1935 the water-soluble portion of the available P_2O_5 decreased from approximately 64 per cent to 46 per cent but was 48.4 per cent for N-P-K grades alone and 50.2 per cent for all P-containing mixtures in 1949–1950.

Summary

A survey of 92 superphosphates and 420 mixed fertilizers marketed in 25 States in the United States during the 1949–1950 fertilizer season showed that 96.8 per cent of the total P_2O_5 content of the superphosphates was in available form and that 84.5 per cent of this was in water-soluble form, whereas only 93.0 per cent of the P_2O_5 content of the mixtures was available and of this 50.2 per cent was water-soluble.

By comparison with superphosphate it appears that on the average, 96.1 per cent of the available and 57.3 per cent of the water-soluble P_2O_5 incorporated in the mixtures remained in these forms. Lower values for P_2O_5 availability and solubility in the mixtures are attributed to formulation practices involving the use of ammoniating solutions and the incorporation of liming materials to offset acid-forming properties of the other ingredients.

The 92 superphosphates represented seven grades marketed by 57 manufacturers, and the 420 mixtures 87 grades, 57 plant-nutrient ratios and 157 manufacturers.

Acknowledgment

Grateful acknowledgment is made to the several state fertilizer control officials whose cooperation made this survey possible, and to A. L. Mehring and K. D. Jacob of this Division and Stacy B. Randle, State Chemist, New Jersey, for design of the survey. ◆

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U. S. population increases by 6,000 persons a day—

NAC Seeks Way To Fill 'Fifth Plate'

Farm Chemicals
Staff Report

THE 225 industry representatives who attended the spring meeting of the National Agricultural Chemicals Association may not have solved the vital problem of "How To Fill the Fifth Plate," but they were made graphically aware of this and several other tasks facing farm chemicals manufacturers.

Meeting in San Francisco's Fairmont Hotel April 6–9, representatives heard reports on pertinent affairs of the industry and its role in helping the country meet food and fiber needs as the population increases by 6,000 persons every day.

Need Publicity

After hearing a plea from Arthur W. Mohr, president of NACA, for a stepped-up public relations program to tell the public what has been done and what will be done by the industry to maintain our standard of living, the delegates considered the following facets of the situation:

1. Relationship of technology and agriculture in the "nip and tuck" battle against problems which threaten to defeat food and fiber production throughout the world.
2. Problem of licensing new pesticides.
3. The task involved in making five acres do the job of six in "filling the fifth plate."
4. How defense functions are carried out in Washington in regard to requirements and production of pesticides.

In discussing the first problem, Dr. Stanley B. Freeborn, assistant dean of the College of Agriculture, University of California, emphasized that many of agriculture's problems, such as increased labor costs, are man-made, and that "the world's population increases faster than the world's food production in the present ratio of 15 to 9."

He said research has aided the industry to meet the demands for increased food and fiber production.

"Agriculture's achievements during the past 10 years have been highly dependent on research in mechanization, fertilization and chemicalization," Dr. Freeborn declared.

Licensing Troubles

Increasing difficulties in licensing of new pesticides were outlined by Joseph B. Cary, executive vice president of the Food Machinery and Chemical corporation.

Cary summarized problems in the production and marketing of farm chemicals.

"Government agencies are tending to insist upon more complete and comprehensive toxicity data usually involving months and even years of testing," he stated.

"In fact," he declared, "under present rules Washington is, to all intents and purposes, dictating for our industry its program and scope."

He said defense agencies allocate basic materials, exports are controlled by several government officials, use is influenced by the Bureau of Entomology and the Food and Drug Administration is the final arbiter of chemicals used in production and processing of foods.

According to Cary the protracted and involved proceedings of the Delaney committee are a symptom of the increasing resistance which new agricultural chemicals will have to face, whatever their claimed advantages technically or costwise.

Research development and the use of new and old pesticides would be seriously retarded by proposed controls represented in the Miller Bill pending in a House of Representatives committee, Cary stated. A bureau in Washington would be the sole judge of whether a new

product would be used in agriculture, he said.

But Cary went on to point out that, because of extreme toxicity and delayed reactions to some of the new products, the attitude of the government agencies in increasing the safeguards for the general public undoubtedly is wise and in the long run will promote through proper use the expanding utilization of new organics in the farm field.

In discussing the third problem, the all-important one of making five acres do the work of six, Lea S. Hitchner, executive secretary of NACA, said U. S. population is growing by more than two million persons a year and the number of our productive acres to feed the people is not keeping up with this growth.

"Let's talk about only the next 25 years," he said. "The number of persons is increasing at an average of more than 6,000 persons a day, 250 persons every hour and four persons every minute."

At the present rate of increase, the U. S. population would exceed 200 million persons by 1975.

But, according to Hitchner, there is a solution to the problem facing the industry in providing enough food for the increased population: "Make every five of our present acres produce as much as six."

"We have kept pace with population by building up acres. Conservation farming has contributed to this increase. Many other things have helped . . . but our acres must be built up still more if we are to meet future food requirements."

In talking about Washington defense functions in regard to pesticide production, William R. Allstetter, deputy director of the Office of Materials and Facilities, PMA, USDA, said "with certain exceptions, no new tax amortization certificate will be issued by the Defense Production Administration unless an expansion goal has been set and this goal is not yet satisfied."

Alstetter discussed sulfur and nitrogen expansion goals and told delegates about the situation in regard to exports of pesticides.

'Drastic Change'

"Many of you already have noticed the drastic change that is taking place in the Department of Agriculture's attitude toward the meeting of production goals," he said.

"Now great emphasis is on increased yields rather than just increased acreage," he stated. "Almost every instruction or release regarding food production that goes out from USDA to field agencies emphasizes the need for using more agricultural chemicals in obtaining our food production goals."

Alstetter stated that substantially this means the two groups of workers who appeared to be working on contradictory purposes in the 1930's "now are cooperating in an effort to improve production techniques. I believe the effects of this change are going to be revolutionary as far as your industry is concerned," the official declared.

"It means USDA is going to be an aggressive pesticide sales agent."

Alstetter concluded his discussion with the opinion that the partnership of the pesticide industry and the USDA "will be closer than ever before with greater benefit both to farmers and to the industry."

In other convention talks, Dr. G. F. McLeod, technical vice president of Sunland Industries, Inc., gave a lengthy criticism of the statistical data collected by federal agencies.

W. C. Jacobsen, assistant director of the Department of Agriculture, California, gave an exclusive review and history of California regulations. Dr. A. M. Boyce, director of the Citrus Experiment Station, University of California, outlined the highlights of a recent trip to the Far East, Near East and Western Europe, where he reviewed the agricultural situation.

Welcome by Ball

W. E. Ball, of Stauffer Chemical company, and president of the Western Agricultural Chemicals Association, welcomed members and 35 wives to the convention.

C. B. Moore, managing director of Western Growers Association, was unable to attend.

Social activities at the four-day convention included a golf tournament for the men and a shopping tour of San Francisco department stores for the ladies.

Meetings were well attended. ◆

John D. Conner, counsel for NAC, addresses convention meeting in Fairmont Hotel. At center is Lea S. Hitchner, executive secretary and Joseph A. Noone, also of NAC.

Arthur W. Mohr, center, NAC president, greets two past presidents at convention in San Francisco April 6-10. At left is G. L. Leonard and at right Ernest Hart.

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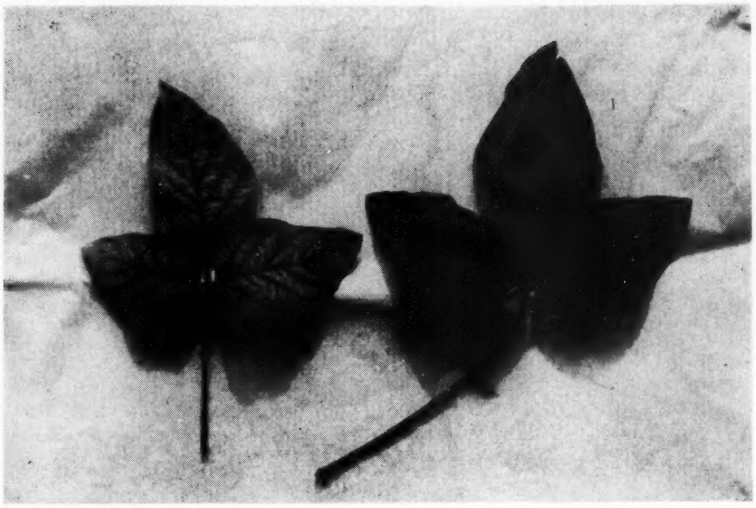
Manganese deficiency in soybeans shown at left. Normal at right.



About 1914 a 'Minor' revolution occurred in agriculture when need was shown for

Minor Elements

By Frank A. Gilbert

Battelle Memorial Institute
Columbus, O.

FERTILIZER usage, like many other farm practices, has undergone great modification in recent years. It has been accompanied by a froth of discarded theories and abandoned methods. Archeological research has shown cultivation of crops was begun by man 10,000 to 12,000 years ago. The first husbandmen at that time probably observed the effect of animal droppings on the growth of plants. A few undoubtedly made practical use of this knowledge.

In America the first white men found that South American Indians long had been acquainted with the fertilizing value of guano, while the story of the use of fish as fertilizer by North American Indians is well known. The Celts are known to have used chalk or marl approximately two thousand years ago.

World agriculture has changed rapidly in the past century but there still are millions of acres of cultivated land where family units eke out an existence on small plots with little or no surplus for urban consumption. In general more food now is produced on larger acreages by fewer people. Supply of animal and other organic manures, in spite of their unquestioned value, hence is insufficient to satisfy even a small part of the needs of present-day large-scale machine agriculture, so vital to world food supply.

Fertilizer is becoming more important each year, with the continuing removal of large crops. Research on the nutritional needs of plants must keep pace in order to maintain our present standard of living and to help countries unable to feed themselves.

One hundred years ago inorganic fertilizer, or chemical fertilizer as we call it now, was virtually unknown, although in Europe, under the leadership of Liebig in Germany and Lawes in England, interest in production of such inorganic plant food was developing.

In the meantime, some use was made of the limited supply of ground bones to supply phosphorus, and for about forty years there was a brisk trade in Peruvian guano. This ended almost abruptly around 1875 when natural deposits approached temporary exhaustion. Its place was taken by Chilean nitrate and during the remainder of the nineteenth century use of sodium nitrate rapidly increased in popular favor. Development of by-product coke-oven ammonium sulfate did not appear on the American market until nearly 1900.

Developed in England

Superphosphate was developed in England in 1842. It increased in importance in North America with opening of the Southeastern phosphate deposits around 1870. Basic slag first was produced for fertilizer purposes about 1880.

This country was not so well off in those early days with regard to potash. German potash salts first were imported for fertilizer purposes in the United States in 1870. By 1900 they had become thoroughly established in our fertilizer market. Germany had a monopoly on potash up to the time of the first World War when the necessity of developing our own potash source was forcibly brought into focus.

At first domestic production was

derived entirely from distillery waste, sea weed and the brine of Searles Lake in California. Then, successful tests for potash were made in the Permian basin of the Southwest and led to the mining of potash salts at Carlsbad, N. M., in 1931. Since that time the United States has been independent of foreign supply.

The first mixed fertilizer was manufactured in the United States in the 1850's but very little was used. In 1900 only about 2,000,000 tons were sold. Moreover, this was of low analysis and rarely reached over 12 per cent of nitrogen, phosphorus and potash, the only ingredients considered to be of importance at that time.

Lime was used but was thought of as an alkalizing agent rather than as a fertilizer. The general policy to prevent fertilizer troubles at the start of the twentieth century was to keep the soil well supplied with N, P and K, and not to allow it to become too acid.

Thinking at this level lasted for some years, as evidenced by tests carried out by experiment stations during that time. Iron, sulfur and magnesium were known to be essential to plants but were deemed inconsequential. Sufficient amounts were considered to be obtainable from the soil or from the amounts involuntarily used in mixed fertilizer and in limestone.

Problem Arose

Then things began to happen. Soils in some parts of the country, especially peats, would not grow satisfactory crops regardless of how much nitrogen, phosphorus, potash and lime were placed on them. Why? Nobody knew. Soil scientists, physiologists and agronomists went to work. It was suggested there might be occasions when iron, sulfur or magnesium might not be everywhere sufficient in the soil. There might even be a few other necessary nutritive elements that had not been considered. Were not zinc, copper, manganese and other ash ingredients invariably present in plants? It had been suggested as early as 1914 that boron was essential. Final proof of the necessity for some of these materials lay in the difficulty of freeing water, nutrient salts and apparatus from minute traces of the elements involved.

One by one additional elements were proved to be essential: manganese, boron, zinc, copper and later molybdenum. Will there be any more? For example, aluminum, fluorine, chlorine, sodium or silicon? Few care to voice a positive statement now. It may be safely asserted, however, that if any are found to be essential they will be in an amount less than that present today in the most highly purified nutrient salts, water and experimental glassware.

Stubborn Soils

Scientists also started an attack on the problems of stubborn soils and those not amenable to ordinary fertilization procedure. The situation was like a huge jigsaw puzzle with many of the sections missing. Gradually a few of the more important pieces are being found and the general picture, although far from complete, is beginning to appear.

A number of different factors are involved, each requiring a different treatment. The layman generally considers a trace-element deficiency is caused by a lack of that element in the soil. This is true only in a small percentage of cases. Often the element is plentiful or sufficient in the soil, but, under certain conditions, is unavailable to the plant. Thus, it is possible for a deficiency to occur because the element was originally missing, or because it had been leached out over a long period of time.

Deficiency might also be caused by the fact that the element, although present, is tied up or made unavailable by microbiological action, or by excessive amounts of organic matter. The element might also be made unavailable by a change in soil pH or by a superabundance of some other element which upsets mineral balance. Each of these factors will be considered separately.

Some soils were shown to have been deficient in certain minerals when attempts first were made to cultivate them. In the Northwest, for example, large areas were unproductive until it was found that a widespread sulfur deficiency existed. Apparently these soils never contained enough sulfur for leguminous crops such as clover and alfalfa. In Australia, the famous ninety-mile desert was a desert only until scientists proved that copper, zinc and phosphorus were almost entirely lacking in the soil.

The Atlantic coastal plain at one place or another has shown a deficiency of every known nutrient trace element except iodine, a micronutrient essential to animals, though not to plants. Soils of this area tend to be acid and are highly leached. Although good crops may be grown on them a higher rate of fertilization is necessary than on soils farther west. Great responses to trace-element applications have been obtained on many coastal-plain soils. Probably these soils were far more fertile when first formed than are the remaining virgin soils of the region today. Leaching in many areas apparently has lowered content of plant nutrients to a point where heavy crop production accompanied by phosphating and liming has produced a marginal condition in regard to trace elements.

Fruit Problems

Fruit growers on the West Coast have had difficulty in preventing zinc deficiency of their trees in certain areas, even though total zinc in the soil was not unduly low. Adding zinc to the soil, even in large amounts, was not remedial, and growers were compelled to use zinc sprays or introduce the element in some form into the trunks and large branches. This peculiar condition occurred because the soil zinc was tightly held in unavailable form, partly at least by microbiological action. Bacteria have also been shown to change manganese salts into an unavailable form and soil organisms are much more important in determining trace-element availability than formerly was believed. Herein lie many unsolved problems.

Peat soils always have been troublesome. Native vegetation grows on untreated peat without difficulty but vegetables do not do well. In Europe such soils were found to be deficient in copper. Livestock feeding on native peat vegetation could not get even the slight amounts of the metal neces-

sary to supply their daily needs. Our peats also were found to be deficient in copper and usually in manganese and zinc as well. Peat soils are formed under poor drainage conditions, either below water or in situations where waterlogg.ng and consequent exclusion of air is the rule. Because of such anerobic conditions residues of natural vegetation are humidified rather than oxidized, and thus tend to accumulate.

Eventually the growing vegetation loses all contact with the original soil and grows entirely in the newer peat layers. As the peat builds up it becomes more organic and contains a progressively smaller percentage of mineral matter. Some peats are 80 to 90 per cent organic matter and burn readily.

It is not difficult to see why such soils are deficient in practically all nutritive elements, with the possible exception of nitrogen. For years there has been no replenishment from the original soil. A 10-foot layer of virgin peat will contain little more mineral material than it did when it was but a fraction of that depth.

Need Minor Elements

When such soils are drained and prepared for cultivation, they require more than lime and the NPK of ordinary fertilizer. The need is nearly as great for the minor elements, especially copper and manganese. With complete fertilization, peat soils become very productive.

The trace-element problem usually is not solved, however, with a single application. Highly organic soils have the ability to tie up in organic and insoluble form a large proportion of applied trace elements. For optimum production, periodic applications of trace elements are necessary. Thus, in peat, as in most other soils, total copper or other trace-element content is far from being indicative of the amount actually available.

The margin between deficiency and sufficiency sometimes is very narrow, and a slight difference in soil pH value is extremely important. Hundreds of cases of temporary boron deficiency occur each year in legume fields where over-zealous farmers use too much

Grower stands in field of cotton which received fertilizer only, in upper photo. Lower: taller crop also treated with copper sulfate.

Peach trees at left received fertilizer and trace elements. Ones at right got only fertilizer. Photo taken at McBee, South Carolina.

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lime. The deficiency is remedied when the pH is lowered or boron is added.

In the Florida Everglades the washings and dust from limestone roads were found on occasion to be enough to set up a manganese deficiency in peat soil for some distance on either side of the road.

One of the least understandable but perhaps most common cause of trace-element deficiency is a lack of nutrient balance. When elements do not become quickly available, or when no single one is present in undue amounts, the soil may be said to be nutritionally balanced. This balance frequently is upset, however, either by natural means or by misuse of the soil.

Manganese Content

Some soils in the Hawaiian Islands contain an unusually high amount of manganese, along with an average amount of iron. This unbalance results in an iron deficiency not amenable to soil treatment. Iron sprays are used to alleviate the condition. The reverse situation can be obtained with high iron and low manganese contents. Such an unbalance is known as antagonism.

In the Aroostook Valley of Maine some growers have added excessive amounts of phosphorus to the soil for many years to increase potato production. The iron content of the soil is not low but in several locations an iron deficiency has occurred because of phosphorus antagonism. A high soil-molybdenum content tends to make copper unavailable. Too much nitrogen may induce the same effect.

Excess potassium can lower calcium content of a plant. This is true also of too heavy an application of magnesium. Many other examples may be cited in which soil applications of large amounts of a plant nutrient result in deficiency of one or more of the others present.

The areas of most pronounced trace-element deficiencies in the United States have been mapped. In such areas application of trace elements or fertilizer containing trace elements usually is a routine procedure. However, there are hundreds of locations where deficiencies are moderate or so slight that animals or plants do not show severe symptoms and may appear normal.

Occasionally, through heavy cropping, use of highly purified fertilizer, too heavy an application of some major nutrient or through extreme drought a localized deficiency may be set up.

Instances of localized trace-element deficiency constantly are cropping up, even in states where little trouble had previously occurred. Similar cases will become more and more common as the policy of considering fertilizer only in terms of nitrogen, phosphorus and potash is continued.

Heavy applications of high-analysis fertilizer add no minor elements and frequently make an already existing nutrient unbalance more severe.

In a recent textbook on soil science it was stated that there is little evidence to indicate copper is lacking in soils other than those of a high organic content. On the contrary, recent experiments have shown that certain mineral soils, e.g., Rains sandy loam and some soils of the Norfolk series contain too little copper for maximum crop growth.

New instances of zinc, magnesium and manganese deficiency constantly are coming to light, and boron trouble is now so common that additional cases warrant little journalistic space.

Molybdenum recently has come in for its share of attention. The writer, in discussing deficiencies on the Atlantic coastal plain in 1948, stated that there were undoubtedly coastal areas with too little of this element for optimal crop production. Such locations now have been found in New Jersey. There is unpublished evidence that molybdenum deficiency may occur in North Carolina, also.

Local Analyses

The natural and quite reasonable thought that comes to one's mind, in connection with location of areas low in an available supply of one or more trace elements, is this: Why not make soil analyses in each field or locality?

Satisfactory tests for N, P, K and calcium are cheap and easy because large amounts present allow for a wide margin of error. With trace elements, it is quite different. Quick tests that have been developed are not accurate enough for the available small amounts of a trace element that may be present in a soil. Skilled personnel and expensive equipment, unavailable in most laboratories, are necessary for accurate determinations. Even some state experiment stations are not equipped to make such determinations. Those that are must use their equipment for experimental purposes rather than for routine analyses.

In addition, cost of a complete soil analysis, which includes available amounts of trace elements, is expensive, even when reduced to its lowest terms. The only way this expense could be brought down is by an assembly-line method, analyzing thousands of samples a year at cost by a non-profit organization or by public funds. Such a soil analysis laboratory is not available at the present time.

With an increasing need for trace-element study, what is being done? Much of fundamental value comes from the United States Plant Soil and Nutrition Laboratory at Ithaca, N. Y. This laboratory is not handicapped by the necessity of confining its research to soils within a single state, as is the case at many experiment stations.

A few experiment stations, notably those in New Jersey and Florida, have pioneered in phases of trace-element research. Much work on molybdenum recently has come from New Jersey, while Florida, by necessity, long has been engaged in developing its soils, many of which are very low in several trace elements. In some states little trace-element work is done, even though micronutrient deficiencies occur.

One of the very few examples of trace-element research on a private basis is that being done at Battelle Memorial Institute at Columbus, O. This endowed and industrially financed institute has been working in the field for approximately a decade. It also is not handicapped by political boundaries, and has conducted experiments in nearly all parts of the country.

One important problem never sufficiently investigated was the location areas of borderline trace-element needs and to determine

(*Continued on page 45*)

Letter to the Editor:

Why Not Try Rock Phosphate?

Farm Chemicals realizes the use of rock phosphate has been a controversial subject for many years and that most experiments indicate superphosphate is superior.

We publish this letter because we feel it is a fresh approach to an important subject. Although we are not convinced of the value of the methods suggested by Mr. Dietz, the opinions we have solicited regarding his theory do not explain to our satisfaction why he is wrong. We think a series of tests might be warranted.

Mr. Dietz wrote this letter with the hope that someone with the time and necessary financial resources would experiment with his theory.

We are eager to present other opinions concerning the theory and are looking forward to receiving comments from readers.

To the Editor:

Articles in Farm Chemicals have reported the scarcity of sulfuric acid and the resulting difficulty in producing sufficient quantities of superphosphate to meet the needs of our agriculture. Many authorities have reported that new methods or materials must be brought into use if the situation is to be improved to any extent.

I feel that the answer to the problem may lie in a method of using phosphate rock that has not been recognized to date. It is a means of creating soluble phosphates in the soil and is based on a theoretical chemical reaction which can occur in a soil containing acid clay.

If tricalcium phosphate, or raw rock phosphate, is mixed with potassium chloride and the mixture applied to a clay soil, the following reaction will occur:

Clay (acidic) plus raw rock phosphate plus potassium chloride yields clay (alkaline) plus soluble phosphate plus calcium chloride.

This theoretical reaction takes place in two steps: 1. Ionization of the potassium chloride in the presence of acid clay to form fixed potassium and free hydrochloric acid and 2. Attack of the hydrochloric acid on the tricalcium phosphate, converting that into soluble phosphate with the liberation of calcium chloride.

The end product, calcium chloride, reacts with more clay and the liberated hydrochloric acid works on more undigested phosphate. I would like to emphasize the idea of repetitive action of the acid radical in the presence of the clay.

The idea of free hydrochloric acid occurring in the soil has been questioned, and in answer I would like to quote from the book, *Nature and Properties of Soils*, by Lyon and Buckman:

"The application to the soil of calcium and magnesium salts of strong acids such as calcium sulfate (gypsum), and calcium chloride, are not usually recommended. The reason is simple. When by base exchange the metallic cations are absorbed and some of the potential acidity of the colloidal matter is liberated a strong acid results. Such acids as sulfuric and hydrochloric, for instance, are not so easily disposed of as weak carbonic acid. While such a salt as gypsum may give satisfactory results at first, its continued use is likely to develop undesirable residues. . . ."

In presenting this theoretical reaction, I realize it will immediately be met with objection. The scientist will ask: "Where are the facts? What field experiments have you to prove this?"

I can offer only one observation, no well controlled field experiments.

In 1947 I grew 90 acres of Clinton oats. I grew these on a number of fields on several different farms on some of which I used an 0–12–12. On two other fields I used a mixture of colloidal phosphate and potassium chloride, home mixed. This was applied on land, the history of which indicated heavy cropping in the past as well as very little return of plant residues.

I also used heavy applications of ammonium nitrate on the soil, a Miami silt and clay loam, at the rate of 160 pounds per acre.

When harvested, no difference in the yields of the various fields could be found that might have been attributed to the difference in phosphate source. The yield in all cases ran 80 to 90 bushels per acre, indicating that the two types of phosphate applied, must have been of approximately equal value.

In placing the fertilizer, I applied it in long thin ribbons, thus giving the colloidal phosphate and the potash salt a broad and intimate contact with the acid soil. The zone of chemical reaction must be very narrow, and future experimenters with raw rock should keep this in mind.

The oats, growing while the chemical reaction was taking place, absorbed the soluble phosphates as they were produced, eliminating the tendency toward reversion.

Potassium chloride is not the only material that might be used with the raw rock. Potassium, calcium, magnesium and ammonium sulfates, ammonium and sodium nitrates, sodium chloride and combinations of these are suggested as possibilities.

My purpose in writing this letter is to try to raise doubt in the minds of leading agronomists so that further experimentation will be carried on.

Using "tagged element" research methods it should be possible to prove or disprove the idea within a short time. With sulfur for superphosphate limited why not try to determine the worth of the proposed method?

E. F. DIETZ
Madison, Wis.

FERTILIZER MATERIALS MARKET

New York

April 10, 1952

Sulfate of Ammonia

This material is in heavy demand and producers are being taxed to get out material against contracts on schedule. There was some export inquiries in the market for shipment to the Far East.

Nitrate of Soda

From a reliable source it was learned that because of a strike at the nitrate mines in Chile, practically no boats have left recently from Chile for the U. S. with nitrate. The leading importer is said to have stocks on hand in this country to last about 30 days.

Ammonium Nitrate

Demand is heavy for this material and producers are shipping as fast as facilities will permit. No prices are noted.

Nitrogenous Tankage

Some sales of this material have been made as far ahead as December with no price changes noted. Most of the leading producers are sold out for the balance of the current fertilizer season. Some imported material continues to arrive at prices of about $6.00 per unit of ammonia ($7.29 per unit N).

Castor Pomace

Demand has increased recently for this material and a limited amount of sales have been made at $37.25 per ton, f.o.b. shipping points, for material guaranteed 6.75 per cent ammonia.

Organics

Organic fertilizer materials showed a mixed tone. Vegetable meals such as soybean meal were offered in a limited way containing some mixture of corn or minerals at $87.00 per ton in bulk, f.o.b. Decatur, Ill., and were being sold as a feed concentrate because of ceiling regulations. A limited amount of linseed meal was offered at $76.00 per ton, f.o.b. Minneapolis on a processing arrangement also because of present ceiling prices. Cottonseed meal held firmly at ceiling prices, f.o.b. Southeastern shipping points, when available. Tankage slipped down in price to $6.50 per unit of ammonia ($7.90 per unit N), f.o.b. Eastern shipping points, and blood sold at the same price. Feed buyers were only buying in a limited way, which accounted for lack of demand.

Fish Meal

Some new production menhaden fish scrap and meal was said to have been sold on a "when and if made basis" for late spring delivery at the ceiling price which was $2.26 per unit of protein, plus cost of bags. Imported fish meal continues to arrive at Atlantic ports and is being sold at prices slightly under the ceiling.

Bone Meal

A heavy demand was noted from fertilizer buyers but demand from feed sources has fallen off to some extent. Fertilizer bone meal, both steamed and raw, is hard to locate for nearby shipment and prices remain steady at $75.00 to $85.00 per ton, according to shipping point.

Hoof Meal

Demand has eased somewhat for this material with last sales reported on basis of $7.00 per unit of ammonia ($8.51 per unit N), f.o.b. Chicago.

Superphosphate

Demand is heavy from all sections but so far no acute shortages have occurred as had previously been predicted. Due to the lateness of the shipping season in some sections, this has helped the situation materially. Triple superphosphate remains tight and hard to obtain except against contracts already written.

Potash

Producers are shipping against existing contracts but in some cases are a little behind schedule because of shortage of box cars and also the unusual demand for quick shipment. Two new producers are coming into the field, with one large producer already shipping in a limited way.

Philadelphia

April 10, 1952

The materials market shows a little more activity. Tankage and blood have declined further. Practically nothing at all is being done in bone meal, and fish is very quiet. Superphosphate remains quite tight, but situation is not critical. Nitrate of soda is affected by the strike in Chile. Demand for potash shipments continues strong and movement is active.

Sulfate of Ammonia.—Supply position is reported tight and contract buyers are taking delivery as fast as produced. However, some of the smaller mixers seem to have a surplus, evidenced by resale offerings from several directions.

Ammonium Nitrate.—Production moves steadily against contracts, with supply insufficient to meet the present strong demand.

Nitrate of Soda.—The strike in Chile is still unsettled. Importers are said to be allocating stocks, and domestic production is reported unable to keep up with the demand.

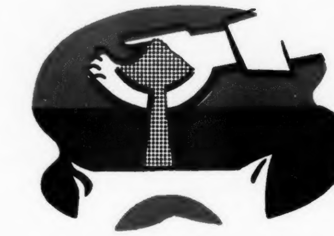
Blood, Tankage, Bone.—Blood and tankage continue in a weak position with prices ranging from $6.00 to $7.00 per unit of ammonia ($7.29 to $8.51 per unit N), depending upon location. Due to the anthrax scare, buyers are showing no interest in bone meal until agricultural and health authorities straighten things out.

Castor Pomace.—A limited tonnage was offered at the contract price of $37.25 per ton at the producing plants.

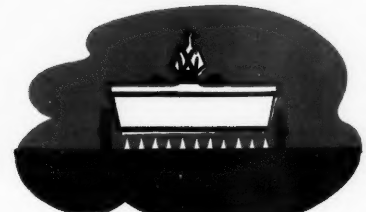
Fish Scrap.—While there is a definite shortage of menhaden, there is ample foreign meal, but no activity in the latter. Buyers prefer to wait until the disturbed situation in bone meal is settled. It is expected the new fishing season will get started in a few weeks, if weather permits.

Phosphate Rock.—Shipments continue to move against standing

DAVISON GRANULATED Superphosphate 3 WAY CONTROL



STORAGE CONTROL—No caking or lumping while in storage.



APPLICATION CONTROL—No dusting or bridging; drills free and even.

FOOD CONTROL — Supplies plant food at a uniform rate.

Now it is possible for you to store superphosphate without fear of its caking . . . that is, if it is DAVCO GRANULATED SUPERPHOSPHATE. DAVCO Granulated Superphosphate will not become hard or caked . . . it is easier to apply in the field because there is no dusting or bridging over in the drill.

DAVCO Granulated Superphosphate gives complete coverage in the field . . . drilling freely and evenly . . . supplying each plant with a uniform quantity of nutrient phosphorus.

Get DAVCO Granulated Superphosphate . . . the superphosphate that gives you the added sales points through its 3-way control.

Progress Through Chemistry

THE DAVISON CHEMICAL CORPORATION

BALTIMORE 3, MARYLAND

PRODUCERS OF: CATALYSTS, INORGANIC ACIDS, SUPERPHOSPHATES, PHOSPHATE ROCK, SILICA GELS, SILICOFLUORIDES AND FERTILIZERS

orders and supply seems ample to meet requirements.

Superphosphate.—Demand continues active with supply not quite able to meet requirements. No easement is presently in sight. There are no resale offerings of this commodity.

Potash.—Contract withdrawals are reported heavy and demand is active. There is still considerable foreign potash in storage in this country.

Charleston

April 10, 1952

Superphosphate throughout the country is in strong demand and potash is increasing in demand. Nitrogen solutions have shown a tendency to tighten. Supplies of hard nitrogen of all kinds are short.

Organics.—Activity is limited in the market for fertilizer organics as practically all needed supplies have been purchased for this season. Last sales for future shipment of domestic nitrogenous tankage were at \$4.25 to \$4.90 per unit of ammonia (\$5.16 to \$5.95 per unit N), bulk, f.o.b. production points. Imported nitrogenous tankage is light. Supplies are at around \$6.25 per unit of ammonia (\$7.59 per unit N), in bags, c.i.f. Atlantic ports.

Castor Pomace.—Production continues limited and prices nominally \$37.25 per ton in burlap bags with \$2.00 per ton allowance if shipped in paper bags. Price is f.o.b. Northeastern production points for material testing minimum 6.75 per cent ammonia.

Dried Blood.—Unground blood in bulk is around \$6.75 to \$7.00 per unit of ammonia (\$8.20 to \$8.51 per unit N), f.o.b. Chicago area and \$6.75 per unit (\$8.20 per unit N), in the New York market.

Potash.—Demand is active in the Midwest and sizable quantities of imported material at the ports have moved to the interior recently. Prices on domestic potash remain firm and unchanged.

Ground Cotton Bur Ash.—Supplies continue available for this potash, primarily in the form of carbonate of potash. For most delivery points the price compares favorably with sulfate of potash.

Phosphate Rock.—Movement continues steady to domestic users and prices remain firm and unchanged.

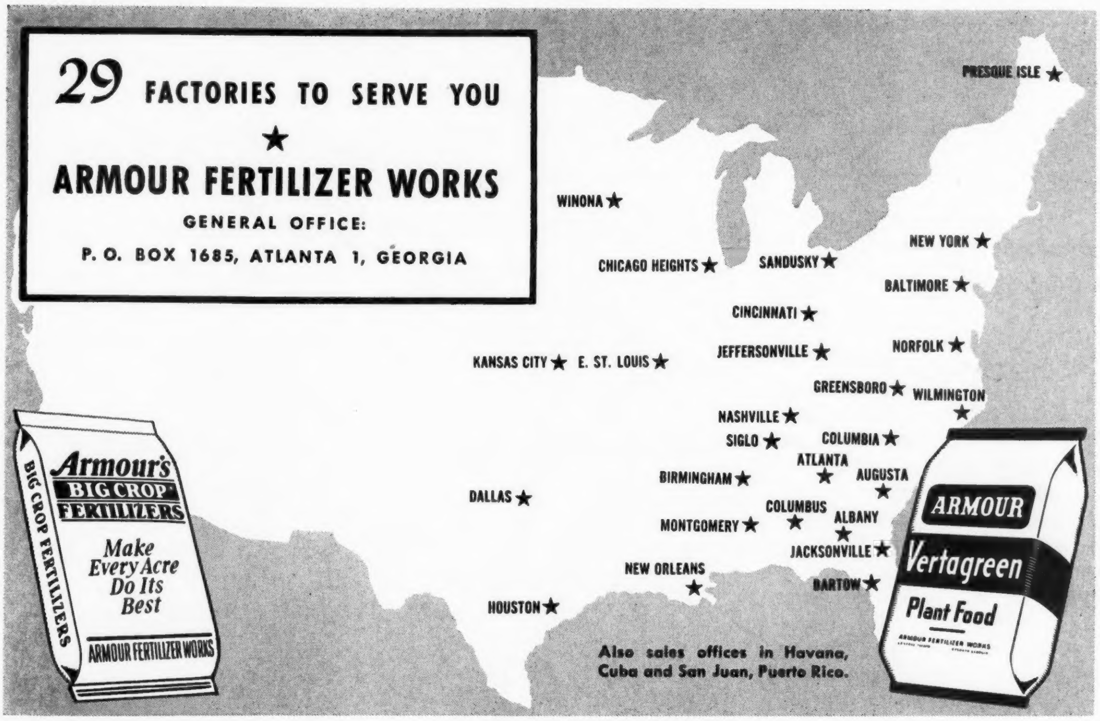
Superphosphate.—Prices remain firm and it has been announced by one of the Baltimore producers that his price is now 87.7 cents per unit of A.P.A., bulk, f.o.b. Baltimore. Demand continues strong in practically all areas. Triple superphosphate continues in a tight market position at 87 cents per unit, Tampa.

Sulfate of Ammonia.—The pending steel mill strike threatens the supply of domestic coke oven material, maintaining the market extremely tight.

Ammonium Nitrate.—This market continues exceedingly tight with demand enormous. Prices remain unchanged on domestic material at \$63.00 to \$64.00, f.o.b. works in bags. Canadian material is priced at \$72.50 bagged, f.o.b. Port Robinson, Ontario.

Nitrate of Soda.—No favorable news of settlement of the strike in Chile has been announced at this writing. Supplies of Chilean nitrate of soda, therefore, will be extremely short in the Southeast during April and possibly part of May. The recent fire at Savannah destroyed part of the March quota of stocks but a fair tonnage will be salvaged. Domestic production continues short of demand.

Calcium Ammonium Nitrate.—Some supplies of imported calcium ammonium nitrate continue to arrive at Charleston, S. C., and are meeting, to some extent, the demand for direct application nitrogen. Prices range from \$60.00 to \$61.00 per ton, in bags, f.o.b. cars Charleston, S. C.


29 FACTORIES TO SERVE YOU
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WINONA
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JEFFERSONVILLE
NORFOLK
GREENSBORO
WILMINGTON
NASHVILLE
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BAG CLOSER
● Requires no installation, supports or plant space ... merely plug into any electrical outlet
● Entirely portable ... weighs only 10½ pounds
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● Handles all types of textile bags and most paper bags
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Lightweight, practical, handy, easy to operate! Efficiency and reliability proved by over 4000 users in every part of the world under varying operating conditions. For details on how YOU can cut YOUR Bag Closing costs with the FISCHBEIN Portable BAG CLOSER ... write:
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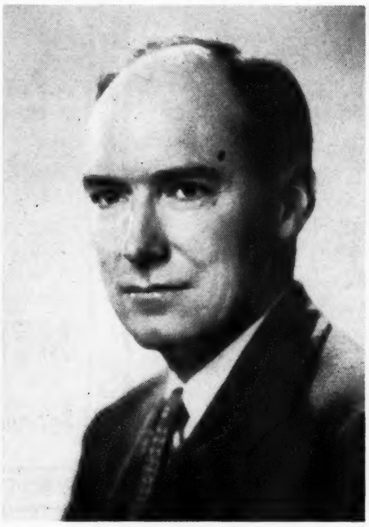
MINNEAPOLIS 3, MINN.

Industrial News

New Products **New Plants** **New Appointments**

New Commercial Solvents Heads

Robert E. Hays



Abbott K. Hamilton

New district sales manager for the Agricultural Chemicals division, Commercial Solvents corporation, is Robert E. Hays. His appointment was announced by Clyde T. Marshall, general manager.

Hays will make his headquarters at Jackson, Miss. He previously was with U. S. Steel corporation as farm products agent in Mississippi.

He received a B.S. degree from Mississippi State College in 1929, and served as a paratrooper with the Army from 1943 to 1945.

Abbott K. Hamilton, a vice president of Commercial Solvents corporation, has been placed in charge of Product Divisions, J. Albert Woods, president, announced.

He succeeds H. J. Henry who resigned recently.

Hamilton has been with Commercial Solvents since 1946 when the corporation purchased Pennsylvania Alcohol and Chemical corporation of which he was vice president.

First Delaney Report Set To Be Released Soon

Farm chemical manufacturers are awaiting with interest the reports of the Delaney committee to investigate the use of chemicals in foods and cosmetics.

The long-awaited statements of the committee will be issued in a series of reports, the first of which should be ready by early June, according to a committee statement.

Four reports covering the various phases of the investigation will be issued. Chemical fertilizer is expected to be covered in the first report. The other reports are scheduled to follow the first, in quick succession.

Speculation has been widespread as to what recommendations for additional legislation would be made by the committee. While a committee spokesman would not reveal this beforehand, it was announced that the first report probably would be concerned with the following questions:

1. Effect of chemical fertilizer on the general condition of the soil;
2. Effect on quality and quantity of plant life;
3. Effect on animals eating the vegetation and
4. The quantity and quality of food growing from soil treated with chemical fertilizer.

Industry Requests Rise In Ceilings for Potash

Higher ceilings for the potash industry have been requested by representatives of the industry.

They urged the Office of Price Stabilization to grant the increase before their new contracts go into effect June 1.

Increased costs of production have made a price rise necessary, according to the representatives. Under existing ceilings, they claimed, they cannot put an increase into effect.

General Ceiling Price Regulations govern pricing in the potash industry.

Paper Supplies Good

Increased production facilities for making paper shipping sacks should make the supply good during 1952, according to the National Production Authority.

During the last quarter of 1951, production was 17.5 per cent above the third quarter production of 200,223 tons.

Miller Relocated

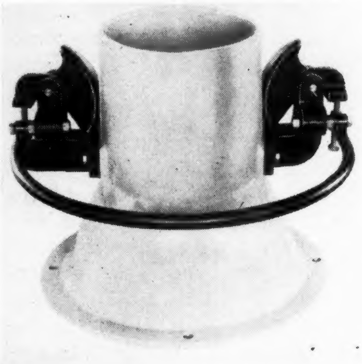
B. T. Miller, who formerly covered the middle western territory for Kraft Bag corporation out of the Chicago office, now will cover Alabama, Mississippi, Louisiana, southwest Tennessee, Arkansas and Texas, the company announced.

Miller's headquarters will be in New Orleans.

Miller long has been identified with multi-wall shipping sacks. For many years prior to joining Kraft Bag corporation, he was engaged in the production end of bag-making.

Industrial News

5-1 Cam-Grip Holder for Bags



Cam-Grip Bag Holder

A new self-locking Cam-Grip bag holder especially designed to suspend 50, 80 and 100-pound multiwall paper bags while being filled, has been developed by Richardson Scale company.

It comprises a bag-holding mechanism mounted on a spout which the user bolts to the hopper or bin outlet.

Empty bags are slipped over the mouth of the spout and up under the cams. The positive grip of the cams holds the bag in place during filling. When releasing a filled bag, a semi-circular release bar is pushed up, releasing the cams and allowing the bag to drop to a conveyor or skid.

The cast-iron spout is secured to the hopper or bin outlet by forming a flange at the outlet and then bolting or welding the top of the Cam-Grip spout to this flange.

Height of the hopper outlet flange should be such that the longest bag will hang about six inches above the conveyor or skid onto which the bag is to be released. For further information on the Cam-Grip, fill out a **Reader Service Card,** using number **5-1.**

Farmers Union to Build

Utah Farmers Union announced recently that as soon as a source of sulfuric acid can be found for processing the rock, it will construct a $5,000,000 superphosphate plant in Utah or Colorado.

Plans Set for British Industries Fair May 5

The 1952 British Industries Fair will be held in London and Birmingham, England, May 5 to 16.

Sir Frank Lee, permanent head of the Board of Trade, reported Britain's National Trade Show in 1951 attracted the record number of 19,266 overseas visitors. He said plans were being made to increase the figure for the 1951 exhibition. This is the largest overseas attendance in the thirty-six year history of the fair.

The 1952 Fair again will occupy three exhibit halls, Earl's Court and Olympia in London, and Castle Bromwich in Birmingham. All exhibit space in the buildings was utilized last year.

Industrial News

NFA, Plant Food Council Plan Big June Conventions

Leading agricultural, industrial and governmental leaders are scheduled to address the spring conventions of the National Fertilizer Association and the American Plant Food Council, to be held on consecutive dates in June.

NFA will gather at White Sulphur Springs, W. Va., while the Plant Food Council will convene at the Homestead, Hot Springs, Va.

Meeting first, from June 16–18, NFA representatives will hear a distinguished group of speakers.

Heading the list are Senator Karl E. Mundt (R.-S. D.), John H. Stambaugh and J. E. Totman, chairman of the board of directors of NFA, who will speak at the opening day session.

Mundt will talk on "Where To in '52," Stambaugh will discuss "Agriculture—An American Business Opportunity," and Totman will present his annual convention address, summarizing the year's activities of the association.

Milton S. Eisenhower, president of Pennsylvania State College, will speak on the topic "Framework for Peace" at the June 18 session. Allan B. Kline, president of the American Farm Bureau Federation, will talk on "Our Agriculture and American Defense." Russell Coleman, president of NFA, will give the annual convention address.

Discussing problems which face the industry will be George V. Taylor, chairman, of Spencer Chemical company; Edwin C. Kapusta, NFA, secretary; Richard E. Bennett, Farm Fertilizers; F. W. Darner, U. S. Phosphoric Products division, Tennessee corporation; Leroy Donald, Lion Oil company; R. M. Jones, Barrett Division, Allied Chemical and Dye corporation; R. A. MacDonald, International Minerals and Chemical corporation; G. F. MacLeod, Sunland Industries, and H. B. Siems, Swift and company.

A record attendance of more than 500 fertilizer manufacturers and leaders in the fields of agriculture, research and education is expected at the American Plant Food Council convention, June 19–22, according to president Paul T. Truitt.

Importance of fertilizer to the national welfare, with emphasis on the major factors influencing the future of farming and the relationship of fertilizers to the food economy will be the theme of the seventh annual convention.

Principal speaker at the banquet session of the convention will be U. S. Senator Harry F. Byrd (D.-Va.).

Others scheduled to address the gatherings include President Truitt, Prof. C. J. Chapman, Extension Specialist in soils, University of Wisconsin; Dr. H. F. DeGraff, professor of food economics, Cornell University, and Rep. Harold D. Cooley (D.-N. C.), chairman of the House Committee on Agriculture.

Agricultural leaders from all parts of the country will participate in a panel discussion on "Major Factors Influencing the Future of Agriculture."

Low Resigns

Marc C. Low has resigned as assistant sales manager of Phillips Petroleum company to become president of Sunset Fertilizer company at Bartlesville, Okla., where the firm is building a $300,000 plant.

SACKETT FERTILIZER PROCESSING SYSTEMS PAY OFF

These fast fertilizer processing systems have reduced production costs in some plants as much as 65% . . . An estimated cost savings included with a Sackett survey of your production operations may even exceed this figure.

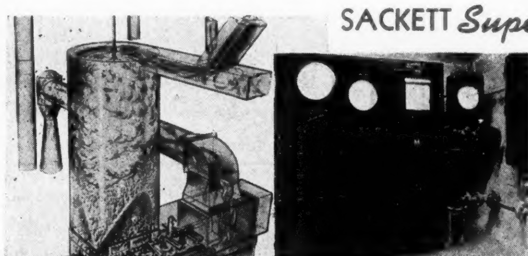
CONTROL PANEL

SACKETT ONE MAN BATCH-WEIGH SYSTEM

1. liminates waste of manpower.
2. Fast-acting weigh valves and printed weigh record provides more rapid and accurate weighing.
3. Circular design of storage hopper accelerates flow of ingredients through weigh valves . . . no corners or valley angles to retard flow of material.
4. Its compact design permits installation in existing buildings with minimum alterations.
5. The installation of this system does not, in any way, disturb existing mixing facilities.

Built in four sizes, 25 tons to 100 tons per hour.

SACKETT *Super-Flo*... A CONTINUOUS SUPERPHOSPHATE MANUFACTURING PROCESS



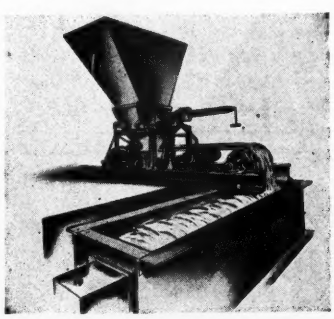
CONTROL PANEL
Central control panel shown above is nerve center of Super-Flo Process. Plant is operated from this point by one man.

This new Sackett-conceived and developed process produces a superphosphate of premium quality in either powdered or granular form. Its complete mechanization and centralized panel control brings to the industry entirely new conceptions of high production speeds, low manufacturing costs and quality product control.

These Sackett patented processes are built in three sizes, 25 tons to 75 tons per hour.

Exclusive suspended acidulation produces highly converted superphosphate of excellent quality.

SACKETT CONTINUOUS AMMONIATING SYSTEM



The patented Sackett Continuous Ammoniation System is now being offered in four sizes with capacities ranging from 25 tons per hour to 100 tons per hour. This highly efficient method of ammoniating superphosphates and mixed goods with solutions offers many important advantages and is easily installed in connection with existing basing equipment. Higher ammoniation rates are made possible by its accurate proportioning of solids and solutions and lower reactive temperatures due to its exclusive aerating action which takes place during ammoniation. This system is also built in pressurized design for anhydrous ammonia or solutions having high vapor pressures.

SACKETT
BALTIMORE

America's Foremost Designers and Builders

SUPERPHOSPHATE PLANTS • FERTILIZER MIXING PLANTS • RELATED PRODUCTION EQUIPMENT

THE A. J. SACKETT & SONS CO., 1707 S. HIGHLAND AVENUE, BALTIMORE 24, MD.

Architects and Manufacturing Engineers to the Fertilizer Industry since 1897

Minor Elements

(*Continued from page 31*)

whether trace-element applications would be advisable on soils where visible crop-deficiency symptoms were not apparent.

Some preliminary work of this type, sponsored by the Crop Protection Institute, had been carried out in Delaware and nearby states. Battelle's work included some two hundred different field trials with the majority in the southern coastal plain area and in the Ohio valley. Tobacco was the principal crop used. Some experiments were made on the effect of one element, usually copper. In many, effects of several elements were demonstrated. Wherever possible, tests were made so that effects of a complete micronutrient mixture were compared with mixtures in which one or another trace element was lacking.

Results were not always decisive, but approximately 80 per cent of the cases were distinctly in favor of the copper- or trace-element-mixture treatments. The indication was that in many locations trace-element applications are beneficial, even where no visual crop-deficiency symptoms appear.

It can not be recommended, in view of these experiments, that trace elements be applied at all times, alone or with standard fertilizer. The suggestion at present is that until complete soil tests are obtainable at low cost each interested grower should obtain a small supply of trace elements and note their effect on a portion of his land.

One objection that has been made to the fortification of fertilizer with trace elements is the possibility of bringing about toxicity of plants through continued use. This is a distinct hazard in the case of boron, but there is little danger with copper, zinc or manganese.

Battelle has had an experiment running since 1946 in which 20 pounds per acre of copper sulfate has been applied yearly to a mineral soil. No indication of toxicity has yet appeared. On a small plot, a single application of 400 pounds of copper sulfate per acre on a clay loam soil, killed seedling tomato plants. Later plantings, without further soil treatment, grew and bore fruit. On peat soils, yearly application of copper is an accepted fertilizer practice.

Micronutrients usually are applied to the soil in the highly refined sulfate form. It has been suggested for some time that other forms such as oxides or even finely ground ore concentrates also might be effective. Battelle tests were run at eight widely separated locations in eastern United States. Several copper compounds, including both finely ground metallic copper and chalcopyrite ore, were compared with copper sulfate as a soil amendment. Tests showed, without exception, that insoluble copper compounds were effective in preventing copper deficiency, although, as might be expected, they were not superior to the sulfate. With the present critical need for copper, manganese and zinc for non-agricultural purposes, use of ground ore concentrate for soil-amendment purposes might be profitably exploited further.

Additional Battelle research has included movement of trace elements in the soil and the effect of their application on the mineral content of certain crops. Considerable work also has been done on development of new and improved methods of trace-element analysis.

Much remains to be done before it will be possible to prescribe correct mineral formula to be applied to a soil in order to insure optimum growth and maximum nutritive quality of the plants grown thereon.

Considering the advances made in the past decade we may expect additional knowledge will be forthcoming to help approach this goal of soil science. ◆

You'll find Raymond Multi-Wall Paper Shipping Sacks carrying fertilizer to farmers everywhere . . . to the man who farms by sections . . . and the man who farms by the acre.

These strong, dependable paper shipping sacks, so easy to handle, so easy to pack, appeal to the quality buyer. Yes, they are CUSTOM BUILT to the particular requirements of the packer and shipper. They are made in various types, sizes, and strengths, available printed in multi-colors or plain.

They are sift-proof, dust-proof, and water-resistant.

A Raymond representative will be glad to assist you in selecting the perfect Raymond Shipping Sack for your needs. Wire, write, or phone RAYMOND today!

THE RAYMOND BAG COMPANY
Middletown, Ohio

RAYMOND *Multi-Wall* PAPER SHIPPING SACKS

Industrial News

5-2 Airslide Conveyor

Among many advantages claimed by Fuller company for its Airslide Conveyor is the ease with which it can be designed and installed to avoid structural obstacles and production equipment. The conveyor operates on the principle of fluidizing dry, fine materials with low-pressure air, so that they flow by gravity, like water on a slightly inclined plane. **Reader Service,** number **5-2.**

Aurora Calcium Opens New Dolomite Plant

Aurora Calcium Enterprises, Inc., has opened a new $250,000 plant to process dolomite for soil reconditioning, near Aurora, Iowa.

The plant is equipped for pulverizing, flash drying and bagging and has capacity of over 200 tons a day.

Officers of the new company are S. A. Patten, president; John Alessio and Peter Stasi, vice presidents and Paul Weishapl, secretary-treasurer.

5-3 Roller Mill

Excellent results in the grinding of various rotenone bearing insecticides have been reported with the Williams Roller Mill, according to the company in a booklet describing the product. Pyrethrum flowers can be pulverized to 98.5 per cent passing 200 mesh. The mill also can be used for grinding DDT and other farm chemicals. **Reader Service,** number **5-3.**

Text matter from the Barrett advertisement illustrated below—

Little Man with a Big Problem

THERE IS LESS FARM LAND than ever before in history to support this young American. He depends on an area of productive soil approximately the size of a standard city block to grow almost everything he eats, wears and uses. And his proportionate share of the land will shrink as he grows older.

The vital importance of fertilizer is brought to the attention of millions of Americans by this full-page Barrett advertisement in The Saturday Evening Post, April 12, and Fortune, April.

Today America has only 2¼ acres of cropland per person, as compared to 3¼ acres in 1920. With our population now increasing at the rate of 4,000 people per day, we will have about 1¾ acres of cropland per person in 1975.

For more than 300 years, America supplied the needs of a growing population by opening new land. But this is no longer possible. Virtually all our available productive soil is now in use. Today this soil is supporting 152 million people. How can we make the same land provide the abundant American way of life for an estimated population of 190 million by 1975?

The fertilizer industry and its 50,000 agents and dealers are supplying the best answer to this vital problem. The annual output of commercial fertilizers has been increased 180% as compared to the 1935-39 period. And continuing research has developed better methods and materials to constantly improve the plant food content of fertilizers.

By using millions of tons of commercial fertilizers, along with other progressive agricultural practices, farmers are increasing the crop-producing power of the soil. Average annual production per acre of all the cropland in America is now 37% greater than it was during the 1935-39 period.

Barrett shares substantially in this major contribution to our country's welfare. Barrett is America's leading distributor of Nitrogen, the plant food element in fertilizers that builds proteins and enables crops to make vigorous growth and produce abundant yields.

Barrett* NITROGEN

*Reg. U. S. Pat. Off.

THE BARRETT DIVISION
ALLIED CHEMICAL & DYE CORPORATION
New York 6, N. Y. • Richmond 19, Va. • Hopewell, Va. • [illegible]
[illegible]

How You Can Get

Free Information

On each of the two postage-paid postcards below you can request further information on four items described on this and the Industrial News section of this issue. ***Fill out one quarter section for each item in which you are interested.***

5-4 Mist-o-cide Generator

"Just pull the tab—". That's the story of Mist-o-cide, the new self-dispersing insecticidal generator, manufactured by Multiphase Laboratories, Inc. The unique, automatic dispersing unit was described in the April issue of FARM CHEMICALS. The company has additional information and specifications concerning development and marketing of the automatic Mist-o-cide generator, which is highly effective for both space and residual killing of pests. **Code Number 5-4.**

5-5 Production Advice

What shall we produce? In what form can our chemical products best be sold? If you ever have been faced with these questions, you may be aided by a pamphlet from R. S. Aries & Associates. Literature from the organization describes how it aids in selecting new chemical products, suggesting new ideas and evaluating products from the viewpoint of your country. The company says its aid extends from overall planning to individual product or process surveys. **Code Number 5-5.**

5-6 Increase Toxicity

A ten-fold increase in the toxicity of nicotine and nicotine sulfate can be obtained by addition of low concentrations of polyethylene glycol fatty acid esters. Glyco Products company, which makes the esters, says the increased toxicity is reflected in both higher percentage kill and speed of kill. Data and specifications on these non-ionic surface active agents is given in company literature. Synergism of the agents with nicotine appears to be the result of improved penetration of the insect cuticle, according to Glyco. **Code Number 5-6.**

5-7 Mikro-Pulverizer

Early in the development of DDT, a Mikro-Pulverizer mill proved its ability to grind the insecticide. Produced by Pulverizing Machinery company, the

Here is a list of the NEW PRODUCTS and BULLETINS described on this and the Industrial News pages of this issue giving their monthly code number.

5-1	Cam-Grip
5-2	Airslide Conveyor
5-3	Roller Mill
5-4	Mist-o-cide Generator
5-5	Production Advice
5-6	Increase Toxicity
5-7	Mikro-Pulverizer
5-8	Thanite
5-9	IMP Mill
5-10	Hou-actinite
5-11	Toximul
5-12	Dispersing Agent
5-13	Lindane Available
5-14	A-B-C Sealer
5-15	New Dust Collector
5-16	Bin-Dicator

FILL OUT READER SERVICE CARDS

FARM CHEMICALS Code Number
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Title..........
Company..........
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Co. Address..........
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FARM CHEMICALS Code Number
Name..........
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FARM CHEMICALS Code Number
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mill can be used for many grinding purposes. Many installations have been made for DDT and benzene hexachloride. The company says the carefully checked performance justifies the claim that the mills granulate the materials with an efficiency unrivaled by any other machine. Operation of the mill insures a free and even flow of granular material ideally suited to the feeders normally used in a tableting machine. A booklet describes the mills in detail. **Code Number 5-7.**

5-8 Thanite

Effectiveness of Thanite as a toxicant in insecticide sprays is described in a new booklet available from Hercules Powder company. The booklet, entitled "Take a Good Look at Thanite," includes tables of comparative testing data and lists formulas using the material. Advantages of Thanite in household sprays, livestock sprays and aerosols also is included. Tests of Thanite alone and in combination with other toxicants were run by independent biological testing laboratories. Results are tabulated in separate tables for three-minute, five-minute and ten-minute knockdown and 24-hour kill. **Code Number 5-8.**

5-9 IMP Mill

Low cost production of blended field strength insecticides can be accomplished by using a Raymond "Whizzer" type IMP mill. Producers of DDT and BHC mixtures, Toxaphene and Chlordane can use the mill to advantage, the company claims. An important feature of the mill is that there are no screens to break, wear or clog. An air separation system is used for classifying and conveying the material. It provides a cooling medium for removing heat generated in pulverizing. Result is a product that is finer and more consistent, a bulletin on the mill explains. **Code Number 5-9.**

5-10 Hou-actinite

Both soil and fertilizer conditioning can be obtained through use of Hou-actinite, a nitrogenous tankage, according to a bulletin of H. J. Baker & Bros. Used as a raw material in mixing fertilizers, it aids in mixing and blending and adds nitrogen, available P_2O_5 and organic matter to the mixture. The material is available in bulk or in bags. **Code Number 5-10.**

5-11 Toximul

For spontaneous dispersion of Toxaphene, Ninol laboratories advises the use of Toximul, the latest in its series of emulsifiers. When added to water of any hardness, concentrates containing the material form stable emulsions with a minimum of agitation. Samples and further information are available, the company states. **Code Number 5-11.**

5-12 Dispersing Agent

Tests show that Darvan, a dispersing agent, increases effectiveness of pesticides in wettable concentrates. Very small amounts are needed for excellent dispersion and suspension, according to R. T. Vanderbilt company. The toxicants are effective and react quicker because of the increased surface area of smaller sized suspended particles. Soluble in water neutral *p*H and stable with mild acids and alkalis, Darvan is not a wetting agent and does not appreciably affect surface tension. **Code Number 5-12.**

5-13 Lindane Available

Lindane for pesticide formulators now is being produced by Kolker Chemical corporation. The Diamond Alkali subsidiary of the organization has commercial quantities available of the 99 per cent gamma material. Prices and specifications are available, the company reports. **Code Number 5-13.**

5-14 A-B-C Sealer

A valuable addition to packaging equipment in industrial plants is the A-B-C Short Sealer, which seals cartons and packages in half the drying time, according to the company. Literature on Model SA describes it as an automatic top and bottom sealer with heaters to dry adhesive quickly. It will automatically seal the top and bottom flaps of packed cases. Optional equipment, such as case counters, printers and power adjustment is available. **Code Number 5-14.**

5-15 New Dust Collector

By controlling dust at its source through specially designed hooding and piping which conveys the otherwise dispersed material to a modern dust collector, American Wheelabrator & Equipment corporation claims excellent housekeeping and clean operations in production of mixed fertilizer. A company bulletin says recovery of 20 cubic feet of salable fertilizer every week is obtained by using the equipment. Company literature gives complete information on the unit. **Code Number 5-15.**

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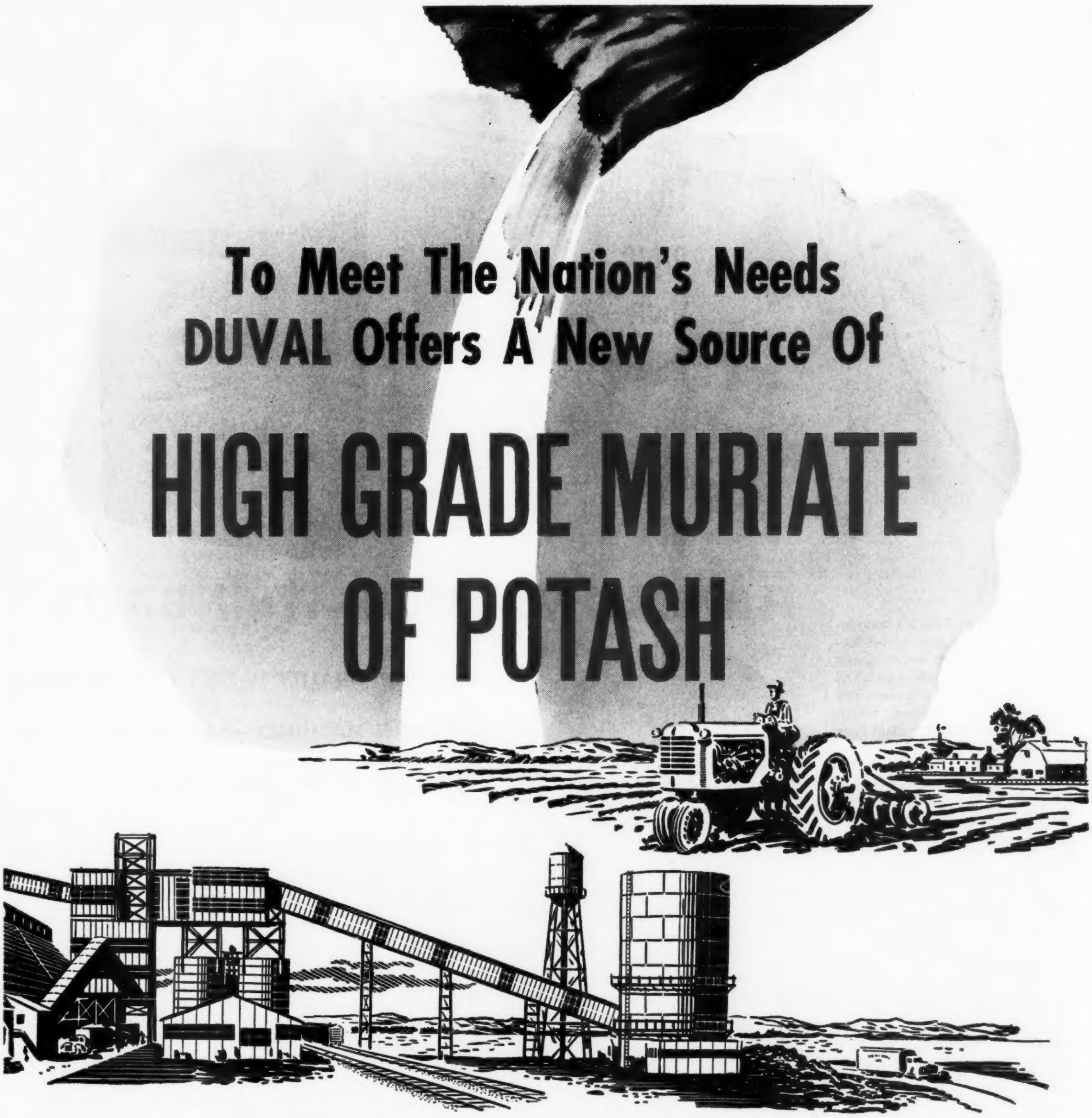
HIGH GRADE MURIATE OF POTASH



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Modern, New Plant and Refinery at Carlsbad, New Mexico

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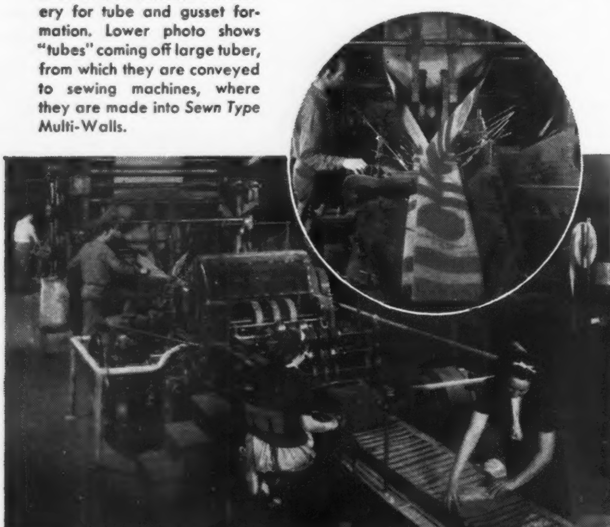
There's more than meets the eye in

HAMMOND *Multi-Wall* BAGS

Insert shows intricate machinery for tube and gusset formation. Lower photo shows "tubes" coming off large tuber, from which they are conveyed to sewing machines, where they are made into *Sewn Type* Multi-Walls.



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Buyers' Guide

Classified Index to Advertisers in 'Farm Chemicals'

A WHOLE FARM THRIVES ON NOURISHMENT

Animal or vegetable . . . each and every living organism on the face of our earth grows 24 hours a day. Nowhere is this so evident as on a farm . . . for a farm's very purpose is to foster a collection of growing creatures and plant life.

Now, every form of growth must, sooner or later, be traced to the soil. And that means the farm's natural resources undergo tremendous drain . . . for this constant nourishing must suck out the rich plant-food elements in the land itself.

That's where soil replenishing fertilizers come in. Many of the most effective of these fertilizers contain POTASH . . . often Sunshine State Potash, a product of New Mexico. This fertilizer is more than a mere soil nutrient. It strengthens crops . . . thereby helping them to resist disease and drought.

SUNSHINE STATE POTASH
A PRODUCT OF NEW MEXICO U.S.A.
REG. U. S. PAT. OFF.

HIGRADE MURIATE OF POTASH 62/63% K_2O
GRANULAR MURIATE OF POTASH 48/52% K_2O
MANURE SALTS 20% K_2O MIN.

UNITED STATES POTASH COMPANY, Incorporated, 30 Rockefeller Plaza, New York 20, N. Y.

Buyers' Guide

Classified Index to Advertisers in 'Farm Chemicals'

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Classified Index to Advertisers in 'Farm Chemicals'

PHOSPHORIC ACID
American Agricultural Chemical Co., New York City
General Chem. Div., Allied Chem. & Dye Corp., N. Y. C.
Monsanto Chemical Co., St. Louis, Mo.

PLANT CONSTRUCTION—Fertilizer and Acid
Atlanta Utility Works, The, East Point, Ga.
Chemical Construction Corp., New York City
Fairlie, Inc., Andrew M., New York City
General Industrial Development Corp., New York City
Monsanto Chemical Co., St. Louis, Mo.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman Foundry and Machine Co., Aurora, Ind.
Titlestad Corporatian Nicolay, New York City

POTASH—Muriate
American Potash & Chemical Corp., New York City
Ashcraft-Wilkinson Co., (Duval Potash) Atlanta, Ga.
International Minerals & Chemical Corp., Chicago, Ill.
McIver & Son, Alex. M., Charleston, S. C.
Potash Co. of America, New York City
Southwest Potash Corp., New York City
United States Potash Co., N. Y. C.

POTASH—Sulfate
American Potash & Chemical Corp., New York City
International Minerals & Chemical Corp., Chicago, Ill.
McIver & Son, Alex. M., Charleston, S. C.
Potash Co. of America, New York City

POTASSIUM PHOSPHATE
Monsanto Chem. Co., St. Louis, Mo.

PRINTING PRESSES—Bag
Schmutz Mfg. Co., Louisville, Ky.

PYROPHYLLITE
Ashcraft-Wilkinson Co., Atlanta, Ga.

REPAIR PARTS AND CASTINGS
Atlanta Utility Works, The, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman Foundry and Machine Co., Aurora, Ind.

SACKING UNITS
Sackett & Sons Co., The A. J., Baltimore, Md.

SCALES—Including Automatic Baggers
Atlanta Utility Works, The, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman Foundry and Machine Co., Aurora, Ind.

SCREENS
Atlanta Utility Works, The East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman Foundry and Machine Co., Aurora, Ind.

SEPARATORS—Air
Sackett & Sons Co., The A. J., Baltimore, Md.

SOIL TESTING APPARATUS
La Motte Chemical Products Co., Baltimore, Md.

SPRAYS
Monarch Mfg. Works, Inc., Philadelphia, Pa.
Spraying Systems Co., Bellwood, Ill.

STORAGE BUILDINGS
Marietta Concrete Corporation, Marietta, Ohio

SULFATE OF AMMONIA
American Agricultural Chemical Co., New York City
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Barrett Div., Allied Chemical & Dye Corp., New York City
Jackle, Frank R., New York City
Koppers Co., Inc., Tar Products Div., Pittsburgh, Pa.
Lion Oil Co., El Dorado, Ark.
McIver & Son, Alex. M., Charleston, S. C.
Phillips Chemical Co., Bartlesville, Okla.
United States Steel Corp., New York City
Woodward & Dickerson, Inc., Philadelphia, Pa.

SULFATE OF POTASH—MAGNESIA
International Minerals & Chemicals Corporation, Chicago, Ill.

SULFUR
Ashcraft-Wilkinson Co., Atlanta, Ga.
General Chem. Div., Allied Chem. & Dye Corp., N. Y. C.
Texas Gulf Sulphur Co., New York City
Ashcraft-Wilkinson Co., Atlanta, Ga.
Woodward & Dickerson, Inc., Philadelphia, Pa.

SULFUR—Dusting & Spraying
Ashcraft-Wilkinson Co., Atlanta, Ga.
U. S. Phosphoric Products Div., Tennessee Corp., Tampa, Fla.

SULFURIC ACID
American Agricultural Chemical Co., New York City
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
International Minerals & Chemical Corporation, Chicago, Ill.
Lion Oil Company, El Dorado, Ark.
Monsanto Chemical Co., St. Louis, Mo.
McIver & Son, Alex. M., Charleston, S. C.
Southern States Phosphate Fertilizer Co., Savannah, Ga.
U.S. Phosphoric Products Division, Tennessee Corp., Tampa, Fla.
Virginia-Carolina Chemical Corp., Richmond, Va.

SUPERPHOSPHATE
American Agricultural Chemical Co., New York City
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Davison Chemical Corporation, Baltimore, Md.
International Minerals & Chemical Corporation, Chicago, Ill.
Jackle, Frank R., New York City
McIver & Son, Alex. M., Charleston, S. C.
Southern States Phosphate Fertilizer Co., Savannah, Ga.
U.S. Phosphoric Products Division, Tennessee Corp., Tampa, Fla.
Virginia-Carolina Chemical Corp. Richmond, Va
Woodward & Dickerson, Inc., Philadelphia, Pa.

SUPERPHOSPHATE—Concentrated
Armour Fertilizer Works, Atlanta, Ga.
International Minerals & Chemical Corporation, Chicago, Ill.
U.S. Phosphoric Products Division, Tennessee Corp., Tampa, Fla.
Virginia-Carolina Chemical Corp., Richmond Va.
Woodward & Dickerson, Inc., Philadelphia, Pa.

TALC
Ashcraft-Wilkinson Co., Atlanta, Ga.

TANKAGE
American Agricultural Chemical Co., New York City
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
International Minerals & Chemical Corporation, Chicago, Ill
Jackle, Frank R., New York City
McIver & Son, Alex. M., Charleston, S. C.
Woodward & Dickerson, Inc., Philadelphia, Pa.

TEPP
Monsanto Chemical Co., St. Louis, Mo.
Virginia-Carolina Chemical Corp., Richmond, Va.

TOXAPHENE
Ashcraft-Wilkinson Co., Atlanta, Ga.
General Chem. Div., Allied Chem. & Dye Corp., N. Y. C.

2, 4-D
General Chem. Div., Allied Chem. & Dye Corp., N. Y. C.
Monsanto Chemical Co., St. Louis, Mo.

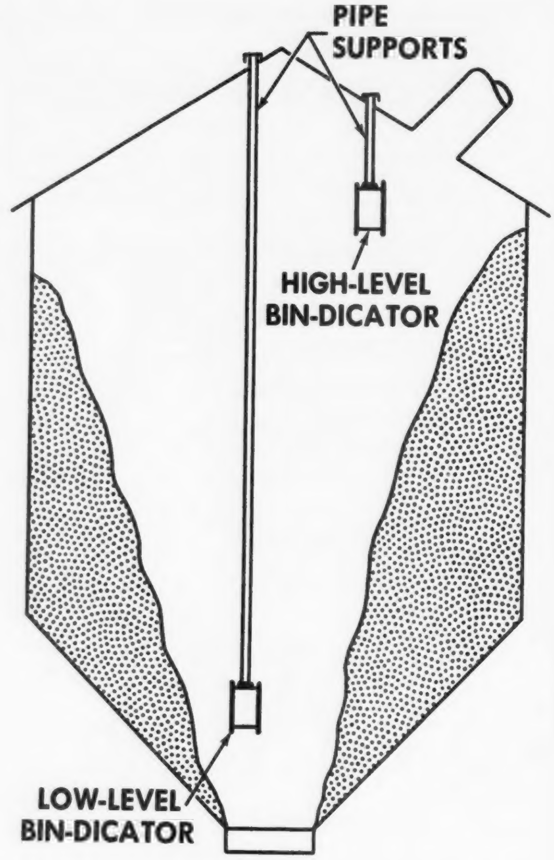
2, 4, 5-T
General Chem. Div., Allied Chem. & Dye Corp., N. Y. C.
Monsanto Chemical Co., St. Louis, Mo.

UREA & UREA PRODUCTS
Barrett Div., Allied Chemical & Dye Corp., New York City

VALVES
Atlanta Utility Works, The, East Point, Ga.
Monarch Mfg. Works, Inc., Philadelphia, Pa.
Sackett & Sons Co., The A. J., Baltimore, Md.

ZINC SULFATE
Tennessee Corp., Atlanta, Ga.

Alphabetical List of Advertisers



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Bin-Dicator

Determining how much material is in a bin at any given time always has been a big problem to the farm chemicals industries.

If the indicator used to do this job is faulty, sticks, or is inaccurate in its indications, lots of money and time can be wasted, and plant efficiency decreased.

All that is unnecessary if a modern unit is used for the job, according to Bin-Dicator company.

Their product, Model CS Bin-Dicator, is a special bin-level indicator which solves the problem of securing dependable level indication in large bins.

The indicator is designed for suspended installation from above and therefore can be located anywhere in the bin where there will be a free flow of material to and away from the diaphragm.

This flexibility as to location permits the successful application of the unit in bins containing materials which tend to build up on the walls of the bin and to flow down through the central area only. Other indicators couldn't cope with this situation, according to the company, but the Bin-Dicator, because of its placement, gives continuous indication.

The installation can be moved up or down easily in the bin or lifted out for inspection. For further information on the Bin-Dicator, fill out a **Reader Service Card**, using number **5-16.**


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